THE

ELECTRICAL REVIEW.

VOL. LXX. MARCH 15, 1912. No. 1,790.

ELECTRICAL REVIEW.

Vol. LXX.] CONTENTS: March 15, 1912. [No. 1790.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4125 (Editorial only).

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.
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Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

COMPULSORY ARBITRATION IN TRADE DISPUTES.

AMONGST the host of persons who are recommending divers methods of settling the dispute in the coal trade is the advocate of "compulsory arbitration."

He does not stop to explain that arbitration which is compulsory is not arbitration at all. In so far as a Compulsory Arbitration Act provides a special tribunal to adjust differences between masters and men it is well enough; thousands of people in commercial circles are choosing arbitration instead of litigation every day. But it is when the element of compulsion appears that a deadlock must be reached. The employer cannot be compelled to keep his mines open, the pitman cannot be made to go to the coal-face. Lacking that "sanction" which goes to the root of the administration of justice in every country, this method of adjusting differences is foredoomed to failure. All this, and much more, can be learnt by contemplation of the results of compulsory arbitration in some of our Colonies.

If the examples which are already on record were only read, marked and learned by the advocates of compulsory arbitration, their zeal would assuredly be abated in a marked degree, for the working of the New South Wales Conciliation Act serves to show that the men have it in their power to "drive a coach and four" through any order of Court which says that they shall work for any particular wage.

In 1903 the miners in the collieries of the Northern district of New South Wales united by their Lodges to form the Colliery Employees Federation as a legal personality under the Arbitration Act, so that the machinery of the Act might be made applicable. The employers formed a similar union. The Arbitration Court was called upon to give an award on disputed points between these two bodies, and it complied with the application, the award setting, *inter alia*, a rate of 1s. 9d. per ton as a hewing rate. The owners and miners were free to contract on the basis of the award. In January, 1903, the miners of the Rhondda Lodge—one of the Lodges of the Employees Federation—being dissatisfied with the above rate, threw down their tools without notices, and went on strike, and rendered idle the mines of the company, Messrs. Smeddon and Laidley, Ltd. These owners, parties to the award, proceeded against the Federation for penalties fixed in the award. The proceedings were conducted in the Arbitration Court, and it was admitted during the argument that the officers of the Federation had tried to dissuade that particular Lodge from acting as it did, and had reprobated the strike; also, that it was customary, in the case of that industry, that 14 days' notice should be given in order to enable a master or a miner legally to terminate the contract of service. The Court held that, as regarded the Federation, no breach of the award had occurred. The fact that the officers of the Federation, immediately on learning

of the resolve of the Rhondda miners to strike, had endeavoured to get them back to work, was held to be conclusive that the Federation was not liable. There remained the miners of the Rhondda Lodge to be considered. The various points settled in, and provided by, the award had been observed. But the award had not made any provision to compel a continuance of the contract under the terms of the award. However, as the miners had struck work without giving the usual 14 days' notice, they would be liable to prosecution as strikers under a provision of the Arbitration Act. The position caused by this decision was not, to say the least, such as was to be expected from a Court whose business it was to bring about a state of permanency in industrial matters. The expense and labour of finding an award was thrown away, as, on the judgment, it was in the power of either of the parties to terminate their contract under it by giving 14 days' notice of their intention. In fine, it appears that if the miners chose to terminate the contract without giving such notice, then the employers could only prosecute them—a proceeding not of the most satisfactory nature; for it might be that in a given case there would not be sufficient gaol accommodation in the country to hold the strikers. The decision will also suggest possibilities in the way of keeping a party under an award clear from penalties, even when certain elements of that party should be guilty of the breaches.

Another case serves to show that the very men who invoke the mediation of the conciliation tribunal are not always prepared to accept its decision as final.

In the early part of 1904 the Newcastle (New South Wales) Coalminers' Federation, consisting of a group of local trade unions, applied to the Court for a readjustment of the hewing rate. The employers, of course, were represented at the hearing of the application, which resulted, to the chagrin of the applicants, in a reduction of the rate. The men at two mines in Teralla, consisting of one union, immediately went on strike, in spite of the advice of their officials. The strikers were theoretically liable to a fine or imprisonment for defying the decision of the Court; but it was impossible to enforce the fine, because both the men and the union were without funds.

The New Zealand Conciliation Act, which has been in force for some years, has also been difficult to apply in practice.

It appears that, in one case, where the Court of Conciliation had decreed payment of a minimum wage by the masters, the firm found that, since the award was made, they had had to dispense with six hands who were unable to earn the minimum wage of £2 8s. a week. Before the award the men received 35s. to 36s. a week, which the employers considered sufficient for the class of work performed. The employers were willing to retain four or five of these hands, provided they obtained a permit to work for a lower wage than that prescribed by the Court. The secretary of the union was applied to, but he refused to grant permits to enable the men to work at the wages named. In another industry it was found that the wages of boys, as fixed by an award, resulted in a loss for the employers. The minimum wage for lads up to 16 years of age was fixed at 10s. a week, with an increase of 5s. per week for each year above that age. The trade being a skilled one, the employers considered that 10s. a week was too much for a beginner, who, during his first year, was really not worth more than 5s. or 6s. a week. One firm in this industry had in their employ a very small lad, who had been in their employ for nine months, and was earning 6s. a week when the award was made; owing to his age, his wages had to be increased to £1 a week, and as the firm could not continue to pay him the increase, he was, after a few weeks, discharged.

We have seen how ineffectual compulsory arbitration has been in the Colonies; is there anything to lead one to believe that it would be more successful in England? For some years the Board of Trade has had power to intervene in trade disputes with the consent of the parties. Upon many occasions awards have been made. We can recall no instance where an employer has refused to honour such an award, but the men have frequently declined to abide by an adverse award, either by going on strike or in some other manner. Even if the award had all the force and solemnity of a judgment, the same course would be open to those who dissented from it. The truth is, of course, that voluntary arbitration has broken down, and if this is the fate of a voluntary system, anything which savours of compulsion must be foredoomed to failure.

THE DESIRE OF THE BRITISHER ABROAD.

Sometimes, basing our comments upon actual evidence placed before us, we have felt compelled to refer to the apparent want of loyalty to British manufacturing of some British engineers at Home. How far it accounted for the largeness of the volume of electrical machinery imported into the British Isles during 1911, who can say? The subject is distasteful, and we gladly leave it in order to express satisfaction at the spirit of loyalty that is sometimes evidenced among electrical engineers who have left the Home country and settled in the Colonies or in foreign parts. During the past few years the departures of electrical men to take up appointments in other countries have been numerous. Every week we have recorded movements of this kind, and while naturally we regret the loss of associates, we welcome the exodus, especially when the emigrants are men who have learnt intimately of the excellence of British electrical work, and of the reliability of the British manufacturer. The average Englishman when he goes abroad does not forget his Home, and prominent in his thoughts of England will ever be his knowledge of our ability to meet requirements, the ordering of which it may be in his power to influence homeward. When the hundreds of men who have recently gone abroad read these lines as they smoke their pipes in calmer reflection than, perhaps, was possible here, they will once more remember that "England expects . . . that every man shall do his duty" by the British manufacturer.

We think that of all the letters that we receive from readers abroad (it is by no means *all* complaint and criticism that we as editors receive), those from our contributors and private correspondents who are eager to keep in touch with Home are among the most entertaining. They tell us that we are to them the link between the new and the old associations, and they show us that, however they may be interested and charmed by the people of other countries,

they want to keep strong every tie which knits them to their blood relations. Sometimes they feel, owing to the difficulties of travel and so forth, that their own kith and kin residing apart from them in the same colony are as far away from them as are we, and they obtain first information of these men's movements and undertakings from our own pages. There are parts of the world where, in the natural course of events, years must elapse before this state of things is materially altered, but it is not so everywhere, and if we can do anything to assist Englishmen or Scotsmen, Irishmen or Welshmen, to come closer together in countries where it is more within geographical possibility, we ought to do it. We have received a letter from a correspondent in Canada which inclines us to touch this subject just now. Thither, during the last few years, scores, we believe hundreds, of young electrical engineers have gone from these shores. In Australia an electrical man arriving from this country associates himself with Australians who are British in experience and in requirements. In South Africa the same thing largely obtains. But what of Canada? There we know all too well that the influence of the United States in electrical affairs has so far been powerful, and the Englishman, if he desires to associate himself with men of a like profession, finds himself surrounded with a United States electrical atmosphere rather than with an English one. Is it desirable to bring about a change? And if so—how can it be done? Let our correspondent speak for himself:—

"Have you any idea how the I.E.E. would look upon a proposal to form a Canadian Section and exchange papers, &c.? As far as I am aware, the only electrical societies existing here are branches of the A.I.E.E., and as an Englishman I object to feeling that we are affiliated to America instead of to the 'old country.' The proposal made above is not original, so evidently there are others, besides myself, who have somewhat similar feelings. Nothing would please me better than to assist in the formation of such a branch, which would constitute one more link with home, if it be possible to do so.

"American methods and standards are already very largely in use here, and unless a stand be made against their adoption, it will be found, as the country grows and becomes more settled, more and more difficult to introduce British methods and standards.

"I think that the I.E.E. at home might be decidedly the gainer if papers were exchanged with a Canadian Section, as the conditions and methods here are entirely unknown to the average engineer and manufacturer at home, and certainly there are many pieces of apparatus, &c., in England, which, if known, would be useful over here. As the Canadian Section grew in importance and membership it would, no doubt, be possible for an interchange of visits to be made which would be still more beneficial to both parties. Canada is almost daily getting nearer to England owing to better steamship service."

Is it beyond the ability of the Institution of Electrical Engineers to cater for past, present, and prospective members in the manner suggested? We have just witnessed the inauguration of a Western Section—why not one Farther West? It will be said that the territory is too large to cover with one local section, and that electrical engineers from this country are scattered far and wide there. It may be that at this stage that would prove an insuperable difficulty, but we do not desire to anticipate the difficulties. What we are anxious to have considered by the Institution, and by the B.E.A.M.A. as well perhaps, is whether some means or other cannot be devised for meeting the need expressed so sincerely by our correspondent and felt by many others who have not written. The question really has an important bearing upon the position of British electrical trading in Canada. American influence has been in the ascendancy far too long in Canadian electrical enterprise and engineering, and it is doubtful whether the necessity has yet been fully realised here for doing something substantial to counteract it. The present time seems to us the psychological moment for action, for there are certain evidences of a Canadian leaning toward this country electrically because of a weariness of American ways.

The I.E.E. and the Domestic Consumer.

The recent announcements of the President of the Institution, with reference to the campaign which that body is about to undertake with a view to promoting the extension of domestic electricity supply, are of the greatest interest to all electrical engineers. The two tariff papers by Messrs. Seabrook and Lackie are understood to form part of this scheme, which aims at obtaining a closer understanding of the domestic consumer and his ways, as a preliminary, we suppose, to the discussion of suitable ways and means of ensuring that he shall embrace to the utmost the hygienic and pecuniary advantages incidental to the use of electricity in the home.

We believe that a great many supply authorities still treat "other uses," on the part of the domestic consumer, superficially. No doubt their excuse is found in the great facility with which apparatus for making "other uses" of gas can be obtained in their localities, and which, more often than not, turns the scale in its favour, even where electric lighting is solely used.

It is no secret that the gas cooker, for instance, has been the salvation of the gas industry, and its universal adoption may be traced almost entirely to the fact that it can be obtained almost as easily as a pound of sugar; the cost of the gas used in it has never been a factor of importance with the user, who indeed pays at lighting rates, and does not scruple to waste gas at that price.

Electricity supply is not on all fours with gas supply, but obviously there are many features connected with the latter which are worthy of most careful study; and perhaps more important than all others is the admirable business and financial organisation which has so successfully filled the great gap between the gas main and the gas consumer. For it must be admitted that at the bottom of the very complex matter which the Institution has decided to probe, there lies the question of finance.

Of the various determining factors, cost of energy is not so important as cost of apparatus, and cost of capital is more important than all. Mr. Highfield referred to this side of the question of electricity supply during the discussion on the earlier tariff paper, when he emphasised the necessity of a sufficient profit margin to ensure the necessary flow of capital into the business. He said it was essential to keep in view the main object of a tariff, which was to extract from the consumer the largest revenue at such a price as would enable a rate of profit to be earned which would attract the investor, or words to that effect; and, further, that unfortunately, owing to so much electrical energy being sold under municipal control, the importance of a sufficient return on the capital was to some extent overlooked—money for municipal enterprises being obtained on the security of the rates, not on the security of the business.

It is almost unnecessary to analyse these remarks closely; one may infer from them that private enterprise, which has full powers to develop electricity supply in any direction, is limited by financial exigencies from doing so, cautious business methods being indispensable to the maintenance of dividends; while municipal electrical enterprise, able to obtain capital cheaply and irrespective of ordinary commercial considerations, and working with the avowed object of providing cheap electricity supply at cut prices and facilitating the means of using it, is, generally speaking, equally impotent to carry out its object to the full.

This is a contradictory state of affairs which calls for discussion, and we commend it to the consideration of those who are about to deal with the problem of extended domestic supply.

Can private enterprise afford to place the electric cooker before the user on the same terms as the gas industry is offering throughout the country, or will it be left for municipal capital to obtain powers, to do this work? Some method of co-operation, involving neither party in questionable methods, appears to be the only probable solution of the matter, which includes questions of manufacturing as well as selling and using.

Smoke Abatement Conference and Exhibition.

The arrangements for this important Exhibition and Conference, which is to be held in the Royal Agricultural Hall, Islington, N., during the fortnight commencing March 23rd, are now well in hand, and elsewhere we print the full programme for the Conference, which is to extend over the three days March 26th, 27th and 28th. The last International Exhibition of this character was held in London in the year 1881, and there ought to be considerable progress to record in the methods and apparatus for securing the smokeless combustion of fuel, that have been worked out and applied practically in the 30 years that have elapsed since that Exhibition.

It is, of course, unfortunate that the Exhibition and Conference should be overshadowed by the great coal mining strike, and one can only hope that this may be settled before the Exhibition opens. To many it may seem in fact somewhat ironical to hold a Smoke Abatement Exhibition during a great coal miners' strike, when the chief problem confronting manufacturers is how to obtain any coal to burn, rather than how to burn it without producing smoke.

But the strike will certainly help to concentrate people's attention on the subject of the more economical use of coal, since it will probably lead to a permanent increase in the cost of fuel; and the cleaner skies and atmosphere resulting from the almost complete suspension of manufacturing operations in the great centres of industrial activity, will prove a useful object lesson in the advantages that may be expected to result in the future from the more scientific and smokeless combustion of solid fuel.

The participation of foreign manufacturers and inventors in the Conference and Exhibition has not been so great as was expected or hoped, many manufacturers stating that a fortnight's exhibition was too short to enable them to recoup themselves for the necessary expenditure of exhibiting. Dr. Louis Ascher, of Königsberg, Mr. T. A. Willard, of Boston, and Herr Ing. Nies, of Hamburg, have promised, however, to read papers at the Conference, and will thus help to preserve the international character of the gathering. Under the presidency of Sir William Richmond, Sir William Ramsay and Lord Justice Moulton, the Conference should be well attended, and the discussions on the papers promised ought to prove both useful and stimulating. A time limit must, however, be strictly enforced both on readers and on their critics, otherwise the results will be disappointing, for Smoke Abatement Societies and Leagues contain many cranks, who are disposed to long-windedness. The suppression of "bores" is an art which every good chairman must excel in, and, most of all, the chairmen of Smoke Abatement Conferences.

REVERSIBLE BOOSTERS.

By C. TURNBULL.

Mr. Rankin's excellent paper on "Automatic Reversible Boosters" has brought forth several problems which may bear further elucidation. Take, for instance, the common requirement that a booster should keep the load constant on the generator. Probably many people imagine that one best which will show the straightest line on the chart of the generator recorder. Yet an analysis of the facts will show that this idea is not justified by experience, save in exceptional cases. If the usual load factor in a traction station were about 30 per cent., with an output which did not alter much from hour to hour, we could deal with it admirably by a suitable combination of generator and battery with booster, the latter having about twice the capacity of the former on short-period rating. Unfortunately, one rarely meets with such conditions. The ordinary traction load is something like this. A little current may be required for night-shift work, and somewhere after 4 a.m. power is needed for workmen's cars, which will make a heavy demand for a short period. The load will then be quiet until 8 o'clock, after which the serious work begins. For the remainder of the day current will go out in a number of rushes when people are taken to business and when they return therefrom, with slack periods in between. If readings on the traction watt-hour meters be taken at the half hours, and if a curve be plotted from these readings, it will be found that the output varies nearly as much as in the case of the lighting board load, and that heavy and quiet times are as much marked in the one case as in the other. The heaviest load is usually about 5 o'clock in the afternoon, when workmen's cars come in, ladened with the sons of toil, followed shortly after by the business men. Saturday afternoons and holidays provide special problems, sometimes very difficult to meet. In some towns there are heavy peaks at regular intervals when a number of cars start off together, ladened with passengers from ferries, the peaks being aggravated when the landing place is at the bottom of a steep hill.

Small systems are greatly troubled with peaks, particularly in hilly districts, as there the number of cars is not sufficient to steady the load. One may add that the difficulty has been greatly increased by the use of meters in cars, as, to save current, drivers get up speed quickly and then coast as much as possible. This heightens the peaks while diminishing the daily output. May one hope that arbitrators will take note of this when settling prices to be paid for traction current.

The actual conditions of traction supply then are totally different from the ideal case mentioned above. Generally speaking, the load factor is less than 30 per cent., while the battery is usually of smaller capacity than the generator, instead of being twice as large, as required to meet ideal conditions. Batteries are usually put in as an afterthought, their function being to take only the peaks which are too heavy for the generator. They are, therefore, much too small to keep a constant load on the generator. One may illustrate the working by a concrete illustration. Suppose that the traction generator is of 200 KW. capacity (small powers being easy to think about), the output being 1,500 units per day, while the peaks go up to 350 KW. Let the battery be of 100 KW. We may run the early and late load by the battery, while the generator may be run from 8 o'clock in the morning until 11 o'clock at night, that is for 15 hours. If it is run at full load all this time it will turn out 3,000 units, a surplus of 1,500 units to overcharge the battery, while the peaks of 350 KW. will be met by overloading the battery 50 per cent. We are thus placed on the horns of a dilemma, for if we reduce the load on the generator to about 100 KW., so that 1,500 units may be out in the day, we shall be unable to meet the peaks, while if we keep the generator up to 200 KW. to meet the peaks, we must waste half the output. This shows clearly that we must not expect to run traction generators at constant load with batteries and boosters, except under unusual conditions. The practical method of working with a battery is something like this. Early morning load up to about 8 a.m. will

be taken by the battery and booster, the latter being compounded to compensate for drop in the battery during heavy rushes of current. The steam set will be run up after eight o'clock, and the booster may be adjusted to keep nearly full load on the generator, when, as the outside load is usually slack during the morning, the battery will soon become fully charged. As soon as the cells gas freely, the booster may be adjusted so that it responds only to peak loads without putting any appreciable charge into the battery. Sometimes, if the outside load be small, sufficient

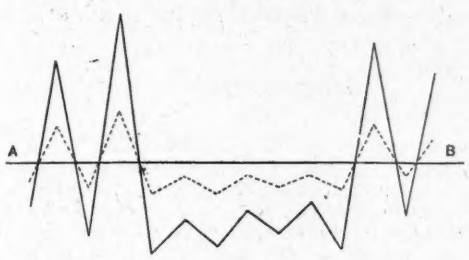


Fig. 1.

current may be run off the battery to bring its pressure slightly below that of the bus-bars, when it may be paralleled with the generator without the booster, which will be satisfactory until the load increases again. In many stations, much of the day traction load is of a perfunctory nature, with occasional spasms, and it is not until late afternoon and evening that there is much life in it. In such places one must run things with minimum loss, and every dodge to save waste must be made use of.

Consideration of the problem shows that most economical running will be obtained where the battery does the smallest amount of work, that is where the battery merely takes such load as the generator cannot easily carry, while ensuring that the pressure is kept reasonably steady. The diagram, fig. 1, will serve to make this clear. In the first case, constant load is kept on the generator as shown by line A B, and it will be noted that not only is there a tendency to put too much current into the battery, but the latter has to take heavy overloads, in which the generator might

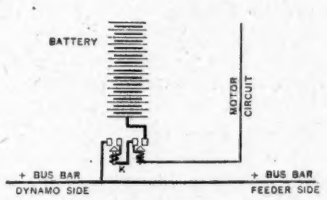


Fig. 2.

easily assist. In the second case, the generator load varies with the outside load, as shown by dotted line, so that the peaks are taken without excessive overload on both battery and generator, while the work done by the battery is a minimum. The latter method is obviously much the more economical. It might be thought from these considerations that the old differential booster would fill all requirements, but a moment's reflection will show that something more is needed. For if the bus-bar pressure be 550 volts, we may put in 270 cells, which give a good working voltage for the battery and do not put too much work on to the booster. The pressure per cell will vary between 2·5 and 1·8 volts, giving us a variation of battery pressure of from 675 to 486 volts. The old differential booster cannot compensate for this automatically, although modern boosters will deal with such variations easily enough. It is less easy, however, to adjust some types of modern booster so that they will cause the generator load to vary with the outside load, so that the work done by the battery may be a minimum.

Circuit-Breakers.—A point may be mentioned here in connection with circuit-breakers. It has happened that the booster-motor breaker has come out leaving the booster breaker in. The booster then becomes practically a series motor without load, and as such may attain to a speed which will cause the armatures to burst. To overcome this the breakers may easily be arranged so that the motor is left on the bus-bars if its breaker comes out, while it is left on the battery if the battery breaker comes out. This has the further advantage that the booster is always left running if one breaker comes out, so that paralleling in is quickly accomplished. The arrangement is shown in the diagram, fig. 2.

Shunting of Series Turns.—Some discussion has taken place on the problem of getting shunted series turns to respond instantaneously to sudden changes of current. Obviously, a sudden rush of current will begin by passing wholly through a non-inductive shunt, leaving the inductive turns to waken up some time afterwards. The delay may be sufficiently long to interfere with the proper working of the booster. Inductive shunts may be used, but they only partially solve the problem, and are not altogether satisfactory. A better method is to shunt part only of the series turns on the booster fields, so that the current must always pass through some of them. Suppose, for instance, that there were 20 turns on the fields, and we arrange to shunt, say, 10 or 15 of them, then the current must always go through the five or ten unshunted turns, so that quick response of the booster is assured.

Saving Resulting from Use of Batteries and Boosters.—When thinking of putting down batteries and boosters, people often ask what will be the saving from the addition. One can only answer that it depends on circumstances. We may best illustrate this by taking two extreme cases. In our first example, we will consider a station which supplies the traction load in a hilly district with comparatively few cars, so that the current is of an extremely peaky nature. The traction generators are just too small to meet the peak loads singly, and it is necessary to run two sets all the time. The motor load on the lighting mains is also too much for the lighting battery, so that a further generator is run on the lighting board. We have thus three sets running all day long to supply an output which might be supplied by one were the load factor suitable. The station costs are necessarily high, and consequently charges must be maintained at a high level. A battery and booster are, therefore, installed, and along with this a motor-generator to act as a link between the traction and lighting boards. (Alternatively, where there is room, it is better to couple both traction and lighting generators to one engine, as in this case we are able to run one comparatively large engine at a good load).

With the new arrangement the entire load of the station may be handled with one generator instead of three, and naturally there is a great reduction in the costs of running. The station will now be in a position to quote cheap rates for power supply, and the yearly loss may be transferred into a handsome profit.

We may now consider conditions where the result of installing a battery and booster will be very different, although really entirely satisfactory. In this case we will suppose that the traction generator is just too small to take the peaks, although it can grapple with the greater part of the load without much trouble. The running costs are at a minimum as the engine is run with a good load factor, but the results are less pleasing to the cars, which often stop on hills, or even run backwards when the engine slows down and drops the line pressure. The engineer determines to put down a battery and booster rather than run up another set. The natural effect of the addition is that costs go up owing to battery losses, in spite of some saving due to the running early morning loads on the battery only, while capital expenditure is also increased. There should be no grumbles, however, at this, but the engineer should rather compare his costs with what they would have been if he had run up another generator on his load instead of putting down a battery, while he should compare the capital cost of the addition with the value of the steam plant which would be required otherwise.

In conclusion, one may point out that the beneficial use of batteries is not confined to small stations. On the contrary, very large plants, such as those at Manchester elec-

tricity works and at the Newcastle-upon-Tyne tramways power station, have found that large savings may be made by the use of batteries and boosters in conjunction with their steam plant. The saving in Manchester is specially noteworthy, as the plant there is of a size to which many people would have expected that no benefit would have accrued from the use of a battery.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE growth of the Canadian West is well shown by the following figures, which give the percentage increase in the population of the Western Provinces during the past 10 years :—

Alberta	424·0 %
British Columbia	103·0 %
Manitoba	80·0 %
Saskatchewan	386·0 %
Total increase	174·0 %

It is impossible for this country to keep pace with her own requirements in manufacturing under present conditions, and there is every indication that this state of things will continue for several years to come.

During 1911 no less than 1,459 miles of railway track have been laid, and within the past two months 260 locomotives have been ordered by the various railway companies ; immense quantities of steel rails are also on order for this year. If the railways find it necessary to strain their resources to the utmost, as they are doing, in order to meet the demands made upon them, there is certainly business to be obtained by other people as well.

The Province of Ontario is to have an outlet on Hudson Bay, while that of Manitoba is to have its limits extended up to that northern outlet, and will, therefore, be no longer termed the "postage stamp" province.

The proposed new line of fast steamships to cover the distance between England and Halifax in 4½ days, will, if it come into existence, make a considerable difference to the trade of the Dominion in the east, while the opening of the Panama Canal will greatly augment that of the ports on the western coast.

Among other developments which are likely to take place as a result of the efforts to make Hudson Bay commercially useful for navigation is the exploitation of the great mineral wealth of Northern Ontario and Quebec and the western shore of the Bay itself, which is said to be one of the richest copper beds in the world.

It is quite impossible to forecast what will be the growth of this country within the next decade ; if unscrupulous company promoters are kept in check, so that public confidence is not destroyed, the development in shipping, railway mileage, power utilisation, road building and other great matters are certain to be phenomenal, and will be accompanied by equally large advances in trade of every kind. These are not the views of the writer only, or of a few people, but those of all the foremost men in the land, and it is generally recognised that the chief difficulty will be to keep pace with requirements in every direction.

Reference was made in these notes some little time ago to the large increase which has recently taken place in the number of advertisements in the technical papers here, inserted by British firms. This increase is still going on, and the latest issue of one of the papers referred to makes special mention of the fact that the number of branches here of well-known British firms is also being rapidly increased.

A Bill has just been submitted to the Provincial Government of Saskatchewan asking for an inquiry to be made into the deposits of lignite in the province, which are said to be of great extent ; it is probable that the question of the utilisation of this material for the production of power by generating producer gas from it will be considered.

A company has just been formed to develop 10,000 H.P. at Seven Falls, St. Ferreol, about 25 miles from the city of Quebec ; the whole of this energy has been contracted for by various industries, &c., in the district.

A large sawmill is being erected in British Columbia which is to have a generator of 1,600 KW., and over 20 motors of various sizes ranging from 200 H.P. down to 7½ H.P.

The Willow River, a tributary of the Fraser River in the same province, has been surveyed, and a recent report states that some 50,000 H.P. could be obtained by suitable development.

The Dominion Government is considering the question of a national system of telephones and telegraphs similar to the British one.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Drawn-Wire Tungsten Lamps.

I would appreciate space in your columns to state the facts concerning several important questions in regard to drawn-wire tungsten lamps.

The first relates to the performance of the drawn-wire tungsten lamp on alternating-current. Statements have been made to the effect that a drawn tungsten wire filament suffers from "off-setting" with reduction of life on alternating as against direct current. This question has been definitely settled long ago by extensive tests, which have demonstrated positively that the drawn-wire tungsten filament gives equally satisfactory life on either alternating or direct current.

Mazda lamps with drawn-wire filaments are guaranteed to give equally good life on alternating current as on direct current, and to give results equal in all other respects to any obtained with the previous types of pressed filament, while possessing a marked advantage in respect of durability.

Another point relates to the durability of the drawn-wire tungsten filament during life service. Statements have been made to the effect that the drawn-wire tungsten filament loses in strength after being burned, and is no stronger than the pressed filament after some hours of use. The fact is that the tungsten drawn-wire filament is many times stronger than the old pressed filament, not only at the beginning, but at any time during the life of the lamp.

Another point that needs correction is the statement that the problem of drawing filaments of pure tungsten was solved in Germany. The fact is that the credit for the development of a filament drawn from pure tungsten must be given to the General Electric Co., of America, alone. Furthermore, their associates, the British Thomson-Houston Co., were the first actually to manufacture and supply such filaments in this country. The other development of a so-called drawn tungsten wire is not a filament drawn from pure tungsten, but one drawn from an alloy of tungsten with another metal. From this alloy after drawing, the auxiliary metal is expelled by heat, leaving the tungsten in a similar condition to that which is found in the pressed or squirted filament.

The real drawn-wire tungsten filament, such as the Mazda filament, is drawn from a block of tungsten—pure tungsten from start to finish, and it is this development for which credit must be given to America.

F. W. Willcox.

London, E.C., *March 8th*, 1912.

Transformer Design.

As the ELECTRICAL REVIEW does not reach India until some considerable time after its publication, I have only just seen Mr. C. Franklin Tubbs's letter pointing out a serious error in my book on "Alternating Currents." The ratio in question is correctly given by him. I need not enter here into any explanation of how the error had arisen, but must content myself with thanking Mr. Tubbs and expressing my regret that he should have been put to so

much inconvenience. I am asking the publishers to insert in future a *corrigendum* sheet into all copies of the book before issuing them for sale.

Alfred Hay.

Bangalore, India, *February 20th*, 1912.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"A. C. P." writes:—"If a builder gives an order for the electric installation in a new building, and then does not meet the account at the proper time, what redress has the contractor? Can he remove the wiring, or as much of the same as can be removed without causing damage to the building?"

*** It may be stated at once that the contractor would have no power to remove the wiring as suggested. As soon as wires and fittings are laid or affixed in a house they become the property of the owner of the building, and to remove them would be to incur the risk of an action for damages for trespass at the hands of the building owner. As to the remedy of the wiring contractor, he may of course sue the builder, but, upon the facts as stated, such an action would probably not be very fruitful. However, such an action would probably result in a judgment, and the judgment debt might be used to garnish moneys due to the builder in the hands of the building owner. The only risk in that case would be that such a garnishee would be the subject of a forfeiture clause, whereby the employer has a right to forfeit in certain events all moneys due.

BRITISH MANUFACTURERS IN AUSTRALIA.

The Australian Association of British Manufacturers and their Representatives has a good record to show for the first year of its existence, which ended at December last. We have been favoured with a copy of the first annual report, from which we gather that there are now 169 members, 71 of these being British manufacturers, and 98 representatives of British manufacturers, representing 629 British manufacturers. The subscriptions received amounted to £254, and the disbursements to £177, leaving a balance of £77 in hand.

Several matters have been brought before the Executive Council, and at least one has already had results beneficial to British trade, and it is expected that further benefits will accrue in the near future. We quote the following from the report:—

Duty on Electrical Machinery. During the passage of the recent Tariff Amendment Act through the Federal Parliament, this Association was successful in obtaining a preference of 5 per cent. for dynamo-electric machines of British manufacture over those of foreign manufacture. In the original Bill, as brought forward by the Government, it was proposed to include generators for direct coupling to steam turbines (on which the duty previously was: foreign, 5 per cent.; British, free) under the heading of dynamo-electric machines, where the duty would have been, for either British or foreign, up to 200 H.P. 20 per cent., and over 200 H.P. 12½ per cent. In this form the Bill passed through the House of Representatives, but, on its coming before the Senate, representations were made by this Association and interviews had with Ministers, with the result that the duty chargeable on articles falling under this item is now: up to 200 H.P., foreign 25 per cent., British 20 per cent.; and over 200 H.P., foreign 17½ per cent., British 12½ per cent.; giving a preference of 5 per cent. to British manufacturers which has not hitherto been enjoyed for any dynamo-electric machines other than generators for direct coupling to steam turbines.

Catalogue Duty. A deputation of members was introduced to the Minister for Trade and Customs by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Australia, in order to make representations urging that British manufacturers' illustrated catalogues be admitted into the Commonwealth free of duty. The deputation was sympathetically received by the Minister, and it is confidently anticipated that a recommendation with regard to this matter will be placed before Parliament in the near future.

Queensland Income-Tax. Representations having been made by several members, protesting against certain powers claimed by the Queensland Commissioner of Taxes to levy income-tax on manufacturers' manufacturing profit on goods sold in Queensland through an agent visiting that State, the matter has been energetically taken up by your Executive Council. British manufacturers and chambers of commerce have lately shown some considerable interest in reference to this matter, and it would be of considerable assistance to this Association if British firms would send in copies of any demands for returns for assessment for income-tax addressed to them by the Queensland Commissioner of Taxes, together with copies of any replies, so that the Association might be fully seized of the position, when the Association will be pleased to advise them in the matter. The information in this office regarding this matter may also be taken as being applicable to Income-Tax Acts of other States.

Post Office Contracts. Objections to the conditions, under Clause 9 (*c*) in the General Conditions of Contracts for the supply of material to the Postmaster-General's department, penalising tenderers 1 per cent. per week on the whole contract if any portion of the contract should be late delivered, have been made by several members of the Association. Your Executive Council are now pleased to be able to report that H.M. Trade Commissioner in Australia has had several interviews with the Postmaster-General and permanent members of of the staff at the instance of this Association, the result of which is that the Postmaster-General now advises that it is the intention of the department to modify this clause to the extent of calling on the contractor to pay only on that portion of the contract the delivery of which has been delayed. Mr. Frazer, however, further indicated that the percentage the department would claim would be more than 1 per cent., and that the penalty would be enforced against any and every contractor, unless under very exceptional circumstances.

We print the foregoing to show the useful character of the work so far done by the Association. The Executive Council urges all representatives to induce their British manufacturing firms to join the Association. "In order to obtain a sufficiently large subscription list, it is absolutely essential that British manufacturers, as well as their representatives, should become members and pay their subscriptions."

We hope that every British electrical manufacturer who exports goods to Australia will come forward and support this very useful Association in a practical manner.

Mr. Percy Rosling (546-550, Collins Street, Melbourne) is the president, and Mr. R. H. Butler, jun., is hon. sec., *pro tem.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Mego-Meter" Insulation Testing Set.

This instrument is similar in construction to other testing sets already on the market, inasmuch as it consists of a generator capable of generating direct current, which is used in combination with an indicating instrument, on the dial of which the insulation resistance is read directly in megohms in the usual way. It is exceptionally simple in use, very easy running, and has the great advantage of being comparatively very light, weighing only 11 lb. The instrument is made for two maximum testing voltages

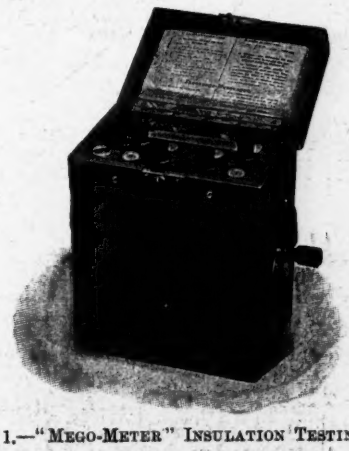


Fig. 1.—"Mego-Meter" Insulation Testing Set.

namely, 240 volts and 480 volts. With the 480-volt instrument tests can also be made at 240 volts, and similarly with the 240-volt instrument at either 240 or 120 volts, four terminals being provided for this purpose.

The instrument can also be used as a voltmeter for testing the voltage of an installation, or for making tests on a D.C. installation, which is carrying current, by making use of the voltage of the system itself in place of that given by the generator contained in the apparatus.

This device has been put on the market by the Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, London, W.C., and we understand that it is being taken up very extensively.

New G.E.C. Instruments.

Several new instruments have been included by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., in their list, Section M, just issued. Fig. 2, p. 416, shows their moving-iron type switchboard voltmeter, for D.C. and A.C., which is now made in three sizes, and for a great variety of ranges; this is now fixed

with a central stem instead of three screws. Air dashpots are used to make the movement dead-beat. Fig. 3, on the other hand, shows a portable moving-coil D.C. instrument, which is made for one to

Fig. 2.—G.E.C. "Aperiodic" Voltmeter, Type C.

three ranges in one, and for a great variety of ranges. The "Salford" standard portable D.C. testing set is illustrated in fig. 4; this combines a voltmeter with five ranges and an ammeter, also with five ranges, of the moving-coil type, with four shunts

Fig. 3.—G.E.C. Portable Moving-Coil Ammeter.

carried in the cover of the case, and covered with a hinged lid. The complete set, capable of reading up to 600 amperes and 600 volts, weighs 16 lb. Mention should also be made of the

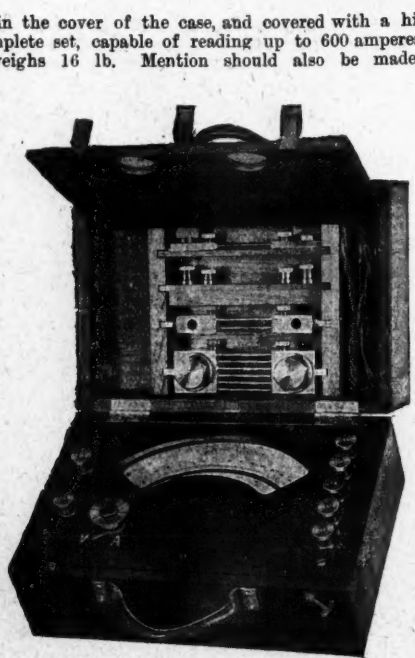


Fig. 4.—"Salford" Portable D.C. Testing Set.

"Sumpner" A.C. wattmeters, Aron meters taking up to 5,000 amperes, &c.

Multiple-Switch Motor Starters for Large D.C. Motors.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.E., have recently introduced a multiple switch motor starter, in which all the switches are interlocked so that they can only be closed in the proper order.

The first switch is different from the others, being a circuit-breaker and having special renewable carbon arcing tips. It is fitted with no-volt and overload releases, and cannot be closed unless all the other switches are open. The closing of it, however, does not put the current through the motor at all. This is only effected when the next lever, which is of the knife-switch type, is put in, consequently if an overload exists at this moment, the first lever or circuit-breaker will open, and having done so, it cannot be closed unless the knife switch is first opened. The arrangement is thus completely fool-proof.

The starters can be fitted with semi-enclosing or completely enclosing covers for the switch fronts if desired. We illustrate in fig. 5 a starter without cover.

Cinematograph Resistance.

A new type of stand-by cinematograph resistance has been introduced by Messrs. Austin Walters & Son, of 57, Lower Mosley Street, Manchester, which we illustrate herewith (fig. 6). This shows a bank of five 15-ampere sections so arranged that by means of knife switches a current up to 75 amperes can be obtained.

The first switch gives a starting current of 30 amperes, the second 45, the third 60, and the last 75 amperes, so that when all the switches are in, a 15-ampere current passes through each section.

The switches can either be arranged on the frame, as illustrated, or on separate brackets to fix in the operator's box, and the cables

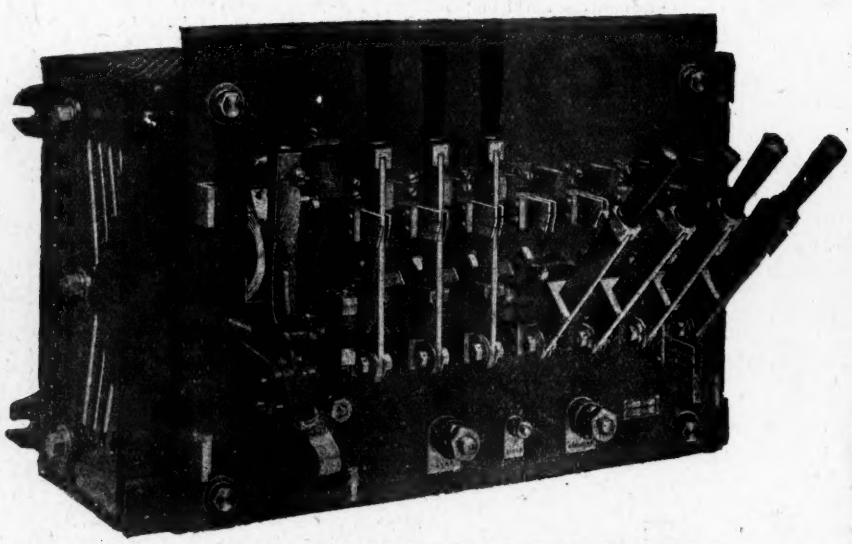


Fig. 5.—E.A.C. Multiple-Switch Motor Starter.

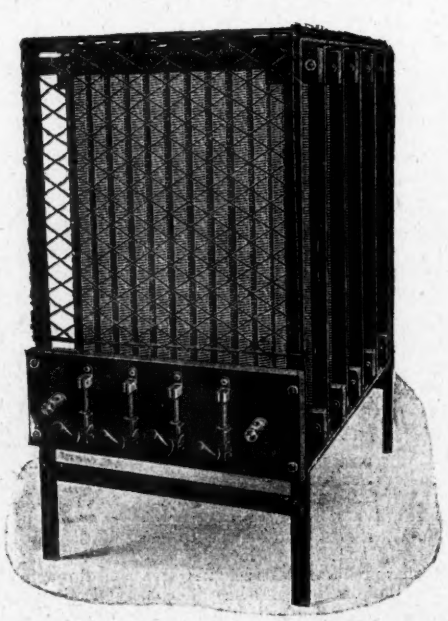


Fig. 6.—Walters Cinematograph Resistance.

run back to the resistance, which can be put in any convenient place. The slates are all bushed and mica-insulated, and non-corrosive resistance wire is used throughout.

"Vickers" D.C. Motor Control Panel.

Amongst other new types of switchgear, the Electric and Ordnance Accessories Co., Ltd., are introducing the standard motor control panel shown in the accompanying illustration, with the lid open. In this, as in their other controllers, the units are of wire wound upon porcelain bobbins, being therefore incombustible, and they are so mounted in the case that they can be readily renewed if necessary. The contact maker is constructed on the same principle as the brushes of a motor—namely, it consists of a brass brush, which is kept in contact with the studs by means of a coil spring bearing on a cross piece, so that although the brushes and contacts may wear, the same even pressure is maintained throughout the life of a brush. Up to 50 amperes, stud contacts are fitted, and above this current the contacts are renewable.

The motor control panel consists of a starter, together with an ironclad combined quick-break lever switch and fuses, as illustrated. The switch is essentially suitable for industrial use, owing to its substantial construction and fool-proof features. The fuses are mounted between the switch blades, so that when in the "off" position they are entirely dead, and can be renewed without danger of shock; also the cover of the switch can only be opened when the switch is in the "off" position.

A combined motor starter and shunt speed regulator is constructed on similar lines to the standard starters, with the addition of a number of shunt regulating contacts. Two arms are provided, one for starting up, and the other for regulating. The regulating arm is provided with a handle, so that in starting up it pushes the

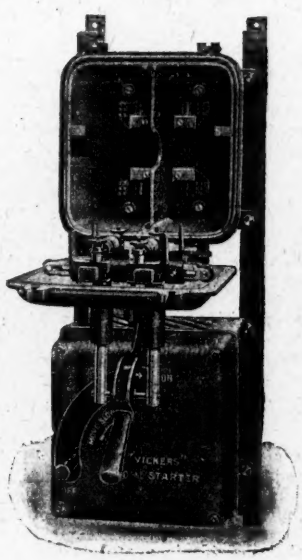


Fig. 7.—"Vickers" Standard Control Panel.

starting arm before it, and when in the "on" position the starting arm is held in place by the no-volt coil, when the regulating resistance can be cut out as desired. With this combined starter and regulator the field is connected directly across the mains until all the starting resistance is cut out, so that it is impossible to start the motor with a weak field. An ample number of regulating contacts is provided, allowing of 100 per cent. increase in speed, the number of contacts varying from 19 to 30, according to the size

The "Field Plug."

Messrs. Feld Bros. & Co., Ltd., of 25, Budge Row, E.C., have introduced a new type of wall plug, characterised by the use of a patent contact. This is shown in section in fig. 8. It will be seen

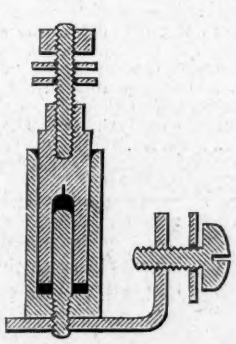


Fig. 8.—Section of Contact of "Field Plug."

that, besides the sleeve, there is a central pin, and the pins of the plug are bored and turned so as to fit both inside and out, ensuring

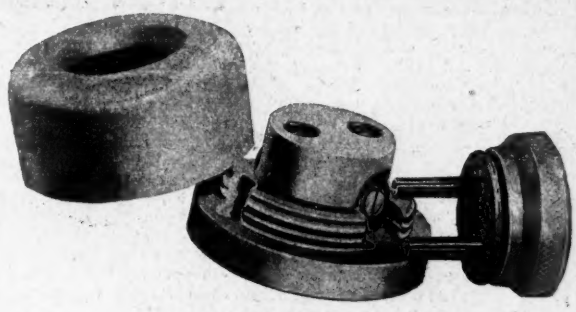


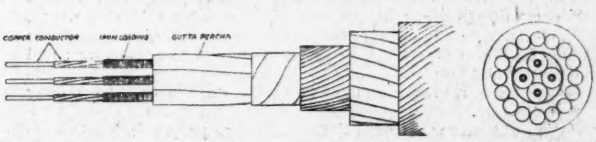
Fig. 9.—Parts of Socket and Plug.

a good metallic contact. The parts of a two-pin plug and socket to carry 8-10 amperes are shown in fig. 9.

THE NEW FRENCH TELEPHONE CABLE.

The accompanying drawing shows the details of construction of the new telephone cable recently laid between Abbotscliff and Cape Gris-Nez by the Telegraph Construction and Maintenance Co., Ltd., on behalf of the French Administration of Posts and Telegraphs.

It will be seen from the diagrams that the cable is of the continuously loaded type, and it is therefore of special interest, because it enables a direct comparison to be made with the Pupin coil-loaded cable laid between the same points to the order of the British Post Office. It is claimed for this type that it has none of the mechanical objections that are inherent in the coil-loaded type. In external



Details of Continuously-Loaded Telephone Cable.

appearance and in general cable construction it is identical with ordinary submarine cables, and therefore presents no increased difficulty either in laying, picking up, or in repairs.

The copper conductor, which weighs 300 lb. per nautical mile, consists of a central copper wire surrounded by five copper tapes according to the method introduced by Mr. Willoughby Smith, and the inductance loading is obtained by surrounding the conductor with a close helically-wound layer of ·012-in. steel wire, the whole being covered in the usual way with gutta-percha to a diameter of ·412 in.

The cable, in all its stages of manufacture, was submitted to rigorous tests by the technical representative of the French Administration, and was found to have successfully met all the requirements of the specification. The attenuation constants as measured after submersion and at a frequency of 1,000 alternations per second were found to be ·00996 and ·00987 per loop kilometre for the two circuits respectively.

LEGAL.

The Northern Light, Power and Coal Co.

On the 8th inst., Mr. Justice Eve, sitting in the Chancery Division, had before him a motion in connection with the action Shrimpton *v.* the Northern Light, Power and Coal Co.

Mr. Gore Brown, K.C., appearing for Mr. Shrimpton, whose address is 46, Queen Victoria Street, London, said the defendant company's head office was in Ottawa, Canada, and its London premises in Moorgate Street. The motion was for an injunction to restrain the company from acting on the terms of a resolution passed at a meeting of debenture-holders in August, 1911. The terms of the resolution in question were that the company should be empowered to issue $1,000,000 of prior lien bonds. Those bonds would be in priority to the first mortgage 5 per cent. gold bonds, which were issued at the formation of the company. The plaintiff's reason for asking for the injunction was that the resolution was passed by debenture-holders at a time when they were under a misapprehension, because of alleged substantial untrue representations of existing facts that were made at the meeting by the chairman of directors. Before going further, he would explain how that suggested representation arose. According to the prospectus of the

company, an arrangement had been made with Messrs. Fuller and Treadwell, the promoters of a company called the Klondyke White Channel Gold and Gravel Mining Co., that they would take from the Northern Light Co. a considerable quantity of electric power. At the meeting of debenture-holders, continued counsel, it was explained that the Klondyke Co. had not carried out that contract, and the revenue of the company had, therefore, not come up to expectations. The contract, however, was enforceable against the Klondyke Co. and Messrs. Fuller & Treadwell, and it was proposed that action should be taken. It was upon that representation, and a statement that a sum of £61,000 would be claimed, that the debenture-holders passed the resolution, although Mr. Shrimpton voted against it. It had since been ascertained that the Klondyke Co. never executed that contract. At the meeting the question was asked whether Fuller and Treadwell were men who could pay if the action against them was successful, and the chairman, Sir Godfrey Longdon, replied in the affirmative.

Mr. P. O. Lawrence, K.C. (for the company): Not one of those present at the meeting was opposed to the resolution.

After hearing the matter further, his Lordship delivered his judgment, and said that he could not grant the injunction asked for. The motion was a strange one, for, although the plaintiff purported to be acting for the whole of the debenture-holders, nobody but himself had come forward to say that he was misled by the alleged misrepresentation. He came to the conclusion, too, that there was no evidence of an untrue representation by the chairman at the meeting, for there was no doubt that that gentleman stated at the time what were the facts, for there was an action pending against the Klondyke Co., and the company believed they had a good claim on the contract. Therefore, the motion would be dismissed, with costs to the defendant company.

Underground Electric Railways Co. and Omnibuses.

In the Chancery Division, on the 9th inst., Mr. Justice Warrington heard the petition of the Underground Electric Railways Co., Ltd., for the confirmation by the Court of a proposed alteration of the company's memorandum and articles of association, which had been unanimously passed at the meetings of the company.

Mr. Clauson, K.C., said the alteration would enable the company to carry on the business of proprietors, manufacturers and dealers in omnibuses, cabs, and public and private conveyances and vehicles of every description, whether controlled or drawn by steam, gas, oil, electricity or other mechanical power, or by animal traction; and of general carriers, railway and forwarding agents, &c.; and to acquire, by purchase or otherwise, controlling or other interests in any stocks, shares or securities of any company carrying on any such business.

His Lordship sanctioned the alteration as proposed.

Fraudulent Use of Electricity.

At Chester-le-Street Police Court, Co. Durham, on 6th inst., John Johnson, an electrician, of Birtley, was summoned for having fraudulently used electricity belonging to the County of Durham Electric Distribution Co. between October 8th and 18th last. Mr. W. S. Burton prosecuted on behalf of the company.

The evidence was to the effect that in Morris Street, where the defendant lives, there are 17 houses supplied with electricity through one meter. Each house was charged a flat rate of 6d. per week in summer and 9d. per week in winter, and limited to seven 8-c.p. lamps and one 16-c.p. lamp, a total of 72 c.p. It was discovered that more electricity was passing through the meter than should have done. It was therefore changed and a new one put in. The old one was tested and was found correct, and inquiries were therefore made. On October 9th it was discovered that the defendant was working in a shed in the yard of the house which he occupied with his mother, and there was an electric light burning there. On October 17th three of the company's officials went there, and found that a connection had been made from the scullery to the shed, that there were three 32-c.p. lamps in use and apparatus for obtaining electric power and the charging of accumulators. These, however, were not in use. It was found that, in addition to the lamps in the shed, there were also lamps burning in the scullery and kitchen. The defendant admitted to one of the officials that he had made a mistake, and that it would not occur again.

Johnson pleaded "not guilty" to the Bench, and said that while the lamps in the shed were burning there were no lights in the house. He did not know that he was acting contrary to the law.

In consideration that this was the first case of the kind taken in the district under the company's Order of 1895, it was decided to treat the defendant leniently, and he was fined £3 and £1 11s. 6d. costs.

A charge against the defendant's mother, Elizabeth A. Johnson, who was a party to the contract with the Distribution Co., was withdrawn.

Charge Against a Traveller.

Before Judge Lumley Smith at the Central Criminal Court last week, Thomas Brittain Johnson, 43, commercial traveller, pleaded not guilty to an indictment charging him with converting to his own use sums of money entrusted to him for his employers, the Electrical Co., Ltd., 122, Charing Cross Road, London, W.

Mr. Frampton appeared for the prosecution, while the defendant was represented by Mr. H. S. Schultess Young.

Mr. Frampton explained that the charges against the defendant were based on the Larceny Act of 1901, and there were five separate conversions alleged against him. The defendant was engaged by the Electrical Co. on June 1st of last year as their traveller in the south-eastern district of London and a portion of Kent. As remuneration the defendant was to receive commission at the rate of 25 per cent. and it was a condition of the agreement under which he was engaged that he should remit all sums received by him for his employers within 24 hours of the money being handed to him. From time to time the defendant obtained orders for goods, and was paid his commission. Last December the defendant's employment was determined by the Electrical Co., and when inquiries were made the subject matter of the present charges was brought to light. In June of last year the defendant brought to the prosecutors an order from a firm carrying on business in Penge. The goods in question were delivered, but the company had never been paid for them. The defendant, however, had received the sum of £6 19s. 7d. in payment for the goods, and had never accounted for the money. On June 28th he received an order from a Penge tailor; the goods were delivered, and the defendant arranged to have a suit of clothes from the tailor in part payment. The clothes cost £4, and a cheque for the balance of the account, amounting to £2 15s., was given to the defendant, which he kept. He also received £6 17s. 6d. from a firm of estate agents at Penge for goods supplied, but none of the money ever reached his employers. In another instance the defendant sold goods to a tailor, and in part payment had a costume made for his wife, the difference being paid to him in cash; none of that money ever reached his employers. When arrested, the defendant said he must admit owing the prosecutors some money, and all they could do was to sue him for it.

For the defence it was argued that the matter was one that should have been dealt with in a civil court, and the defendant should have been sued for any amount that was due to the prosecutors.

The jury returned a verdict of not guilty, and the defendant was discharged.

Urban Electric Supply Co., Ltd.

Mr. Justice Neville, sitting on Tuesday last for the disposal of company business, had before him a petition by this company for the reduction of its capital. The matter has already been referred to in our "City Notes."

There was no opposition, and his Lordship sanctioned the reduction as proposed.

United Lighting and Maintenance Co., Ltd., *v.* Wm. Liesegang.

In the High Courts, on Tuesday last, the Official Referee, Mr. Muir Mackenzie, gave judgment for a sum of £478 8s. 9d. in favour of the plaintiff, against defendant, trading as Liesegang & Kosch, of Magdeburg, Germany, in respect of a contract for the supply of electric lamps.

It appeared that defendants agreed to supply plaintiffs with 50,000 electric lamps, but failed in their deliveries, with the result that plaintiffs claimed the above sum as loss of profit and extra expense for having to buy on the market to supply customers.

No appearance was put in for the defendants.

Action Against a Lampmaker.

In the Chancery Division, on March 11th, Mr. Justice Swinfen Eady gave judgment for the plaintiff in an action by the Public Trustee (for the beneficiaries under the will of one Frank Griffiths) against Mr. Ernest Bohm, electric lamp-maker and general electrician, asking for an injunction to restrain defendant from committing a breach of a covenant under which he was the lessee of No. 45, Hillmarten Road, Holloway. Plaintiff complained that the lease of the house in question was granted to defendant on one condition, among others, that it should be used as a private dwelling-house only, but, in breach of that covenant, defendant had carried on the manufacture and sale there of electric lamps.

In his defence, Mr. Bohm denied that his acts amounted to a breach of the covenant of his lease, inasmuch as he had only carried out experiments in connection with his electrical business in the cellar of No. 45, Hillmarten Road; his business was really carried on at a workshop in St. George's Road.

Having heard evidence on both sides, however, his Lordship granted the injunction asked for.

The Manchester Electro-Harmonic Society.—The first smoking concert will be held on Friday evening, 22nd inst., at 7 o'clock, in the Marble Hall, Albion Hotel, Manchester, at which the president, Mr. S. L. Pearce, will take the chair. An excellent programme has been arranged by the musical director, Mr. W. J. Smith, and we are asked to state that the committee will be very pleased to see as many gentlemen present as possible. Tickets, admitting two gentlemen, may be obtained from the Hon. Secretary, 24, Brazennose Street, Manchester, or from any member of the committee.

BUSINESS NOTES.

Private Arrangement.—A private meeting of the creditors of D. W. A. Roberts, trading as D. Roberts & Co., Station Street and Junction Road, Eastbourne, electrical engineers, convened by Mr. C. R. L. H. Harvey, the largest creditor, was held on Monday at the Great Eastern Hotel, E.C. Mr. Mills, solicitor for Mr. Harvey, explained that his client held a mortgage on the debtor's lease, &c., and a charge upon the book debts in respect of advances made to the debtor, and on February 15th the mortgagee appointed Mr. H. H. W. Perkins, of Eastbourne, accountant, receiver under the mortgage. The object of the meeting was to receive a report and statement of affairs from Mr. Perkins, and to consider a scheme providing for the payment of the debtor's liabilities, and allowing him to continue the business. Mr. Perkins submitted a statement of account showing a surplus over liabilities of £199. He said that the debtor commenced business in small premises in Station Street in 1904, having previously been engineer-in-charge of the Eastbourne Electric Lighting Works. He started without capital, and, therefore, had been handicapped throughout his career, and on various occasions he had borrowed money from Mr. Harvey, which had been repaid with the exception of £200, which was secured by a mortgage dated September, 1908, and a loan of £70 from the same gentleman. The business, which began in a small way, had been progressive and prosperous, the trading amount for 1911 showing a turnover of £4,828, a gross profit of £1,071, and a net profit of £506. The premises in Station Street are held on a lease upon which Mr. Harvey holds a mortgage, and the Junction Road garage was held under an agreement for a lease. Each of these premises is in a desirable situation, and consequently both leases are of considerable value. They had not, however, been valued, and did not appear in the statement of affairs. Four writs had been issued, and the largest trade creditor was in a position to issue execution. There was also claims for rent, rates, &c., which had to be met at once. The debtor has been appointed electrical expert to the Devonshire Park Co., Eastbourne, from which he received £3 a week besides a profit on the sale of sundries. Mr. Perkins stated that the debtor had undoubtedly good prospects if given time to free himself from the pressure caused by shortness of capital. Mr. Mills suggested that the business should be continued by the debtor in the usual way, at a salary, and subject to the supervision of a trustee to be appointed on behalf of the creditors. Mr. E. Hawkins, C.A., having gone into the position on behalf of the largest creditors, recommended the acceptance of the proposal, and calculated that under it the creditors would get about 10s. in the £ in six months, and the balance in the future. There was a lengthy discussion, and eventually it was resolved to take a deed of assignment, subject to Mr. Harvey giving up his security, the trustees to have power, on the instructions of the committee of inspection, to sell the business as a going concern or to wind it up, whichever they thought fit. Mr. H. H. Perkins, accountant, of Eastbourne, and Mr. E. H. Hawkins, of Charterhouse Square, E.C., were appointed joint trustees with a committee of inspection. The following are creditors:—

Anglo-American Oil Co.	£182	Eastbourne Corporation ..	£27
East London Rubber Co. ..	90	Avon Rubber Co.	56
Harvey, C. R. L. E.	68	Lanchester Motor Co.	40
Bransom, Kent & Co.	45	Phleumatic, Ltd.	35
Soddy, R. J.	90	Swires	65
General Electric Co.	29	City Ignition Co.	21

Prices Advance.—Mr. G. Braulik announces that owing to the recent advance in the cost of platinum and the large increase in cost of all raw materials, prices of bells, buzzers, relays, &c., listed in his Section "B" bell catalogue, have been advanced. Prices of indicators, brass pushes and other lines have also been advanced by 10 per cent.

Preventing Vibration.—Amongst recent orders to insulate foundations against vibration, the Korfund Co. have received the following:—

Belfast.—Two 120-h.p. Diesel engines.
Sheffield.—One 300-h.p. Hornsby Stockport gas engine.
South Shields.—Picture Palace, one petrol-generator set.
British Museum Station.—B.T.-H. motor and Sirocco fan for Ozonair plant.

"Metroflam" Arc Lamps.—In our "Contracts Closed" last week it was stated that the Glasgow Corporation had accepted the offer of Messrs. Johnson & Phillips, Ltd., for 30 flame lamps. We now learn that the order received by the firm is for 48 "Metroflam" magazine flame lamps, having a specified duration of 120 hours. This makes a total of 248 "Metroflam" lamps for the Glasgow street lighting. The following is a list of some important orders booked by the firm recently for these lamps:—

Blackpool Corporation, 154 lamps; Great Central Railway (Immingham Dock), 200 lamps; Croydon Corporation, 58 lamps; Hawthorn, Leslie & Co., Ltd., 66 lamps; Newcastle Corporation Tramways, 22 lamps; Palmer's Shipbuilding & Iron Co., Ltd., 60 lamps; Charing Cross, West End and City Electricity Supply Co., Ltd., 150 lamps.

Bankruptcy Proceedings.—E. D. Hawker and A. S. Finch, lately carrying on business as the British Accessories Co., at 119, Pentonville Road, N.—A sitting of the London Bankruptcy Court was held on Wednesday, March 6th, for this public examination. The accounts showed debts £517, and assets valued at £71. It appeared from the evidence of the debtors that they commenced business in November, 1910, with £100 capital as electrical manufacturers, and traded until last October, when, being without working capital, they abandoned the business. In February, 1911, they purchased the patent rights for this country in an advertising device called the "Albright Sign," together with the goodwill, stock, &c., of a business in connection therewith, and afterwards exploited the device in conjunction with their other business. The failure was attributed to lack of capital, loss in trading, and to loss on the purchase of the sign business. The examination was concluded.

British Trade with Japan.—The Far Eastern Advertising Agency, Ltd., of Craven House, Kingsway, are preparing for circulation in Japan, where their head offices are situated, a "Buyers' Guide" in the Japanese language, entitled the "Japanese Register of British Trades." A special feature will be a classified index of manufacturers and exporters. They invite firms of standing in Great Britain to send in entries without delay, as the compilation is now near to completion.

Thermit Welding.—Messrs. Thermit, Ltd., London, have received the order for the welding of the joints on the Belfast City Tramway extensions, amounting to about 7 miles double track. They have also orders in hand for welding at the following, among other places:—Blackpool, Bradford, Bristol, Liverpool, Manchester, Newcastle-on-Tyne, Sheffield, Rotherham, Southampton, West Hartlepool, Southend.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." February, 1912. London: E. & F. N. Spon, Ltd. Price 5s. net.—The issue for February contains the following papers: Chairmen's Addresses at Manchester, Dublin, Scottish, Yorkshire and Newcastle Local Sections; High-Voltage Transmission, by W. T. Taylor; The Mechanical Design of Direct-current Turbo-Generators, by R. Roberts; National and International Standards for Electrical Machinery, by Dr. R. Pohl; Small Electricity Supply Undertakings, by P. A. Spalding; The Mutual Attractions or Repulsions of Two Electrified Spherical Conductors, by Dr. A. Russell; Total Loss and Hysteresis of Magnetic Sheet Materials, by A. C. Campbell, H. C. Booth, and D. W. Dye.

"Applied Science," Vol. V, No. 4. February, 1912. Toronto: University Engineering Society.

"Memoirs of the College of Science and Engineering." Vol. III, Nos. 7 and 8. January, 1912. Kyoto, Japan: Imperial University.

"The School of Mines Quarterly." Vol. XXXIII, No. 2. January, 1912. New York: Columbia University. Price 50c.

"Storage Batteries." By Harry W. Morse. London: Macmillan and Co. Price 6s. 6d. net.

"Science Abstracts." Sections A and B, Vol. XV, Part 2. February 26th, 1912. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 2. February, 1912. New York: The Society.

"*Bulletin* of the Iowa State College Engineering Experiment Station." Vol. IV, No. 6. December, 1909. Ames, Iowa, U.S.A.: The College.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVIII, Nos. 1, 2 and 3. November, 1911, and January and March, 1912. Newcastle-upon-Tyne: The Institution.

Coal Strike Delays.—In case any of our country readers should find this copy of the Electrical Review coming to hand a few hours later than usual, will they kindly note that it is due to curtailment of the railway service consequent upon the continuance of the coal strike. The Great Northern Railway Co. have suspended the East Coast Scotch Express leaving King's Cross Station at 5.5 a.m., week days, until further notice. Correspondence for places in England and Scotland, usually forwarded by this train, will be sent by the earliest subsequent trains on the same line of railway, or by other routes, but unavoidable delay in the delivery of all classes of correspondence will result from the suspension of the train in question, and the general curtailment of the services on the various lines of railway.

The British Westinghouse Electric and Manufacturing Co., Ltd., issued a notice to their customers, dated March 1st, to the effect that in view of the general coal strike they were unable to depend on the supply of material necessary to enable them to proceed with work in progress, and although they had taken the precaution to lay in, as far as possible, a stock of supplies which would help them to some extent, it was inevitable that there must be delay in the completion of a very great many orders in hand. Guarantees and promises for the delivery of apparatus now on order, as also those which might be given in connection with new inquiries, must be contingent on delays due to the strike.

Messrs. Siemens Bros. Dynamo Works, Ltd., have issued the following notice from Caxton House, S.W., under date March 12th: "We beg to advise you that owing to the existing coal strike and its consequences, we are suffering delays at our Stafford Works and in the receipt of raw materials and of materials from our suppliers and sub-contractors, which will inevitably delay the progress of the work now in hand. We therefore regret that we are obliged to give notice that any promise or guarantee we have given for completion of our orders in hand, and any given, or to be given, in connection with new inquiries, must be subject to delays caused by the strike, and that we can take no liability whatever in respect of any loss, damage or injury caused thereby. We would ask indulgence in respect of these delays, the inconvenience resulting from which we are doing our best to mitigate."

Catalogues and Lists.—Messrs. Andre Citroen and Co., 27, Queen Victoria Street, London, E.C.—New edition of their brochure, entitled "Citroen Gears at Work." It contains a number of new illustrations of these gears working under a great variety of conditions

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—Pamphlet containing particulars of their small-power slow-speed steam turbines, notes on the advantages claimed, and a table of dimensions, speeds and powers. Also a new edition of their 18-page catalogue (No. 1,021) of high-pressure fans for foundry work. Electric high-pressure fans are illustrated and described, also air valves, countershafts, and sheet-steel air piping.

Messrs. Eastman & Warne, 241 and 243, Acton Vale, London, W.—Catalogue of 16 pages, giving particulars of their electrically-heated apparatus, the system of construction, advantages claimed, notes on the loadings of heating apparatus, &c. The manufactures, in which the firm has made remarkable headway since it began experimental work on electric irons some eight years ago, include "Hot-point" domestic irons, laundry and factory irons, "Eadisk" cookers and hot plates, the "Belenus" electric boiler recently described in our pages, soldering irons, branding irons and muffles, and various accessories. We understand that the branding irons, as exhibited at Olympia last autumn as an example of the degree of heat that could safely be obtained with the "Hot-point" iron, have been the subject of a number of repeat orders from those who bought the irons during the Exhibition run.

Messrs. Perry & Grinsell, Ltd., 1 and 2, Leopold Street, Birmingham.—A 24-page catalogue of electric heating and cooking apparatus has been issued. The manufactures appearing and priced in the list comprise electric kettles in brass, copper and tin, porridge pots, frying pans, food-warmers, warming plates, cooking plates, large and small ovens, oven and grill, electric irons and convectors. The list is well produced, and the front page bearing the maker's name is perforated for removal by contractors, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New catalogue (M Section, ninth edition) of about 50 pages, containing illustrated descriptions and tabulated prices of measuring instruments, a number of new lines being included. Switchboard instruments, portable instruments, recorders, meggers and bridge meggers, "Aron" meters and time-switches, these are some of the variety particularised. Special attention is directed to the type "C" moving iron aperiodic instruments, 6-in. dial portable instruments, standard portable testing sets (the "Salford"), and the "Aron" watt-hour shunted clock-type meter. Some of these are referred to in our "New Devices" to-day.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C.—24-page pamphlet containing illustrations, and with full particulars of prices very clearly shown, of various materials used by contractors in electric light and power installation work, motors (from ½ to 26 H.P.), cables and flexibles, "Graetzin" metal lamps, tantalum lamps, "Sunshine" flame arcs, carbons, lamp-holders, switches, ceiling roses, wall plugs, casing, shades, Holophane glassware, &c. At the new Polytechnic in Regent Street, visited by the King and Queen on Monday, the building is fitted throughout with "Graetzin" metal lamps and Holophane glass reflectors supplied by Messrs. Feld Bros. & Co.

Messrs. Siemens Bros., Dynamo Works Co., Ltd., Tyssen Street, Dalston, London, N.E.—Eight-page price list (W.L., 1.) dealing with "Wotan" pure drawn tungsten wire lamps, the front cover of which bears a reproduction in colour of their "Wotan" lamp poster now being displayed on the London underground railways. The pamphlet contains illustrations and prices of all grades of these lamps that are now on the market. Also a new 24-page price list (D4) of Holophane glass-ware, including the latest types of reflector bowls in the "Stiletto" and "crystal" types. Several pages are occupied with illumination data for electrical contractors' reference. Among other specialities in the list is the "Bank" unit, consisting of a "Stiletto" reflector of either intensive or extensive type, with a green opal shade to slip over the exterior prisms of the Holophane reflector, the whole being supported by a screwless gallery. The fitting can be fixed to any ordinary bank or counting house standard for efficient desk illumination. The "Billiard" unit, which is also shown, consists of a Holophane glass shade surrounded by a green conical cardboard shade surrounding the outer prisms which directs the light over the billiard table.

The Silent Electric Clock Co., 192, Goswell Road, London, E.C.—Leaflet showing a view of a corner of their fitting and testing room, where a number of clocks of various sizes for the Home Office are being tested. The master clock consists of one of their little half-seconds master movements fitted to a case with 12-in. dial.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Leaflet illustrating in colour their "Rainbo" colour changing electric lantern for cinematograph theatre and other advertising service.

Big Typewriter Contract.—The Western Union Telegraph Co. has ordered 10,000 typewriters from the Underwood Typewriter Co., delivery to be given at the rate of 1,000 a month.

For Sale.—Messrs. G. N. Dixon & Co. will, on March 27th and 28th, sell by auction at Trefriw, North Wales, a quantity of electrical mining, ore dressing and contractors' plant. See our advertisement pages to-day.

Chloride Contracts.—The Chloride Electrical Storage Co., Ltd., have recently received an order from the Admiralty for a battery-booster plant for H.M. Dockyard, Simons Bay, South Africa. An Entz booster and Chloride battery was recently installed at the Leith Docks, and a somewhat similar plant was shipped to Egypt for the Soudan Government Railways. The company are just completing the erection of a battery of 230 cells for the Wolverhampton Corporation, with a capacity of 7,000 ampere-hours at the three-hour rate.

Trade Announcements.—Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., have appointed Mr. C. W. Fairweather, jun., of Cathedral Buildings, Dean Street, Newcastle-on-Tyne, to be their representative for the Newcastle district.

Messrs. Engineering and Arc Lamps, Ltd., announce that their Chingford Works being inadequate to cope with the demand for Beacon flame lamps and other specialities, their St. Alban's Works have been extended and further equipped with up-to-date tools; the manufacture of Gilbert and Davy arc lamps will now be carried on solely at Sphere Engineering Works, St. Albans, Herts, and all communications should be addressed there.

Messrs. David Brown & Sons (Hfd.), Ltd., of Park Works, Lockwood, Huddersfield, announce that arrangements have been made for the reconstruction of their business by the formation of a new company, bearing the same name as the existing company, but with a largely increased capital, in order to cope with increasing trade. Part of the capital has been offered to the public and has been fully subscribed. The existing company will be wound up voluntarily (the liquidator being the secretary, Mr. T. E. Whiteley), and all the assets will be transferred to the new company. All accounts incurred since September 30th last will be received and paid by the new company. The business will be continued under the same management.

The Langdon-Davies Motor Co., of Southwark Works, Deverell Street, S.E., have acquired the whole of the assets and goodwill of the Langdon-Davies Motor Co., Ltd., as a going concern, and they will continue to manufacture every type of motor made by the old company. They announce that they are removing to a new works equipped with modern machine tools, and they intend to maintain the reputation of the L.D. motor as a British-made machine. The present plant, which is inadequate to meet the demands made upon it, is to be disposed of, but this will in no way affect the continuity of the business. The staff is being retained as in the old company, the only alteration being in the management.

The business of the late Mr. Wm. Cogger, electrical engineer, 9, Earl Street, Maidstone, will be continued by his son, Mr. W. E. Cogger, senior.

Liquidations.—Rugby School Electric Lighting Co., Ltd.—A meeting is to be held on May 13th at Rugby, to hear an account of the winding-up from the liquidator, Mr. A. E. Donkin.

Re-Organisation and Control Syndicate, Ltd., 2, Coleman Street, E.C.—First meetings of creditors and contributories respectively, March 26th, at Carey Street, W.C.

LIGHTING and POWER NOTES.

Accrington.—Three applications have been made to Accrington Mill Building Co. for a plot, between Peel Mill and Milnshaw Park, for the purpose of erecting a weaving shed. The land is nearly an acre in extent, and, if worked by electricity, the shed will hold about 700 looms of standard width, along with preparation machinery. The individual drive system is generally regarded in this part of Lancashire to be the most economical. An experiment on these lines is being tried with some 22 looms in the Accrington locality, and this is being watched by many manufacturers with the greatest interest.

Argentina.—The Municipality of Coronel Vidal (Province of Buenos Ayres) has accepted the tender of Mr. F. Maya for installing the electric light in that town.

Axbridge.—The R.D.C. has decided to assent to the application of the Winscombe E.L. Co. for permission to extend the overhead supply mains to Cheddar.

Barking.—With reference to the application of the U.D.C. for a loan of £11,000 for E.L. purposes, the L.G.B., as the result of the recent inquiry, has advised the Council to call in an independent expert engineer to report upon the whole position of the undertaking, and particularly as to whether the proposed extensions are required, and, if so, as to what form the extensions should take. It is further pointed out to the Council that at the time of the inquiry, the E.L. account was overdrawn to the extent of £5,040. In reply, the Council has informed the L.G.B. that it has considered the matter carefully and for a long period.

Birkenhead.—As a result of the agitation carried on for some time by users of electrical energy residing outside the borough area, the T.C., on 6th inst., decided to reduce the charges to consumers in Bidston, Noctorum, Upton and Prenton from 7d. to 5d. per unit.

Blackburn.—We understand from the engineer, Mr. Wheelwright, that the concluding sentences of our note last week on the recent L.G.B. inquiry at Blackburn are liable to mislead readers. The inspector's remark that he did not think the Board would sanction the loan until something definite was decided, referred only to one sum of £2,400 for improvements, &c., in condensing water supply, and not to the whole scheme of improvements, which we understand was presented in complete form and accepted by the inspector. We regret that the note should have left an erroneous impression.

Blackburn.—It is stated that the Tramways and Electricity Committee has carefully considered the effect of the coal strike on these departments. The coal at the electricity works would enable them with great care to go on for a month. They intended to reduce the tramway service by about 50 per cent., which would give them a considerable decrease in the coal consumption. They also intended to reduce lighting on the tramway routes as well as other routes. The big lamps would be put out altogether and the smaller middle lights utilised.

Bognor.—A B. of T. inquiry was held on March 8th into the application of Mr. Wm. Tate for powers to supply electricity within the township. Mr. Tate, who is chairman of the U.D.C., has already a generating station supplying a number of large buildings, and his scheme includes a three-wire system of supply. The estimated capital expenditure, including about £3,000, the value of the existing generating station, which is to be extended, is £22,050, and it is proposed to supply current at 5d. per unit. The gas company opposed the application.

Bootle.—The T.C., at its meeting on March 6th, unanimously approved the recommendation of the Electricity Committee with regard to the extension of the electricity works at a cost of £43,755, outlined in the report of Mr. T. D. Clothier, borough electrical engineer, submitted to the Council on December 6th, 1911. In accordance with the resolution of the T.C. passed on January 3rd (Electrical Review, January 12th), "That before the Council approves the scheme an independent electrical engineer be appointed to criticise the scheme, such person to be a practical engineer in charge of an electric works giving a public supply, and to be appointed by the President of the Municipal Electrical Association," the extension scheme had been submitted to Mr. C. E. C. Shawfield, who reported: "After carefully reviewing your engineer's recommendations, I am of the opinion that the scheme is a sound and well-considered one, and based upon the latest central station experience." The matter was brought up on the minutes of the Finance Committee, which contained a recommendation declaring that in the Committee's opinion the expert's report was satisfactory, and that the Electric Power and Lighting Committee should proceed with the scheme.

Brechin.—The Corporation, which recently took steps to acquire the local gas undertaking from a company, has to face the unusual problem of modification or annulment of its agreements with the electricity company, which carries out the street lighting. The North of Scotland Electric Light and Power Co. has had the contract for lighting the streets since 1902, but it has apparently occurred to the Council that a gas lighting system would be cheaper. How the problem will be solved is a matter of importance also to Montrose, a neighbouring burgh, which is in a somewhat similar position as to its agreements with the same company regarding public lighting. In the case of Brechin, it was stated in a supplementary agreement that the T.C. would take from the company sufficient energy for the lighting of the whole of the streets wherein main cables are laid, "always providing that the expense of lighting the public streets shall not exceed the present cost of lighting the streets by gas, and the company undertakes that the streets lighted by electric light shall be at least as well lighted as they are now by gas." The electric system is up to date, and the lighting only cost £462 in 1911.

Bray.—A L.G.B. inquiry has been held concerning the application of the Urban Council for sanction of a loan of £3,500 for the purpose of extending the municipal electric lighting works. Mr. J. McCaul, accountant, gave evidence, and stated the electric light undertaking had not paid in the past, but that it was doing so now. He attributed the latter fact to the increased consumption for private use. In reply to the Inspector, he said they had done wiring in private houses. Mr. Bradshaw objected that the Council had no power to do that. Mr. McCaul stated that the practice had been discontinued since Mr. Bradshaw threatened to take an action against the Council. In reply to the Inspector, Mr. McCaul said a credit balance on the electric lighting account in 1911 of £120 had been applied to the relief of the general rates. He further stated that there was a debt of £1,000 on the electric lighting works, which was covered by an overdraft on the bank, which was guaranteed by members of the Urban Council. Mr. Sowter, the Council's electrical engineer, said that if they increased the price of electricity they would lose a very large number of customers. He believed that the new machinery would last 20 years, the period of the loan. They expected to make a profit by the increased number of consumers.

Brighton.—The T.C. has, by 25 votes to 19, rejected a scheme of assisted wiring of consumers' premises. The opposition was based on the ground that the scheme would be unremunerative.

Burnley.—The Electricity Committee has considered its estimates for the ensuing year, and has recommended that if the profits anticipated during the year ending March 31st, 1913, are sufficient for the purpose, £4,500 be paid into the borough fund. The Committee considered a letter from Messrs. Lupton Bros., and the electrical engineer submitted a return showing the charges made in 32 towns for electrical energy supplied for lighting purposes during restricted hours. It was decided that the Council be recommended to charge 2d. per unit for electrical energy used for lighting purposes between sunrise and sunset, the consumer in each case to pay the cost of the special meter necessary to record the consumption of electrical energy during the period. This is a reduction of 1d. per unit.

Canada.—In all probability a great electric power plant will be erected at the Chats Falls, 30 miles west of Ottawa, on the Ottawa River. This was intimated a few days ago by Hon. Adam Beck, of the Ontario Ministry, and head of the Hydro-Electric Commission. The Commission has taken steps to expropriate the Chats Falls and develop power, largely for the City of Ottawa, but for many other towns in the vicinity. The water available at Chats Falls is sufficient to develop 120,000 to 150,000 H.P., and is thus equal to the supply at Niagara.

Mr. Thomas Surtees, who has thoroughly investigated the question of Ottawa River powers, gives Chats Falls 141,000 H.P. A report indicates that extensive additions to the plant of the Electrical Development Co., at Niagara Falls, will be made. The power house is to be extended to the south, the addition to be erected costing over $200,000. Four more power units are to be installed, increasing the power development from 80,000 H.P. to 120,000 H.P., and the transmission line to Toronto will be duplicated. Altogether a sum of about $1,000,000 will be spent by the company on the contemplated improvements.

Carnarvon.—The National Electric Construction Co., Ltd., has applied for an additional provision to be introduced into its Bill confirming the wiring agreement with the Carnarvon T.C.

Continental Notes.—France.—La Société Hydro-electrique de la Haute Bourne is the name of a new company which has lately been formed at Grenoble with a capital of £20,000 to put down a plant to utilise the water-power of the River Bourne in the generation of electrical energy for lighting and power purposes.

Germany.—A municipal commission appointed by the city of Flensburg, is about to make a journey to Berlin with a view to studying the various systems of municipal electric undertakings, as a preliminary to the establishment of an electric service in Flensburg.—*Elek. und Maschinenbau.*

One of the largest overland central stations in existence is in course of completion in the kingdom of Saxony. It is that of the Groba electricity union, which comprises four principal districts composed of 850 localities. The generating station is situated at the works of the Lauchhammer Co., at Lauchhammer, which commenced trial working at the end of January. The electrical energy is transmitted at a pressure of 100,000 volts to Riesa, whence it is passed by means of a ring main to five transformer stations, and thence into a distributing system having a total length of 740 miles, covering an area of 1,150 square miles. It is said that commercial considerations have induced the union to use copper and aluminium in equal halves for the overhead lines.

Belgium.—La Société des Ateliers de Constructions Electriques, of Charleroi, has recently completed a generating station at Brée, for public and private lighting purposes, which is of more than passing interest, inasmuch as it is an attempt to provide electricity for small villages which have hitherto been unprovided with any means of lighting other than is afforded by oil lamps. The town of Brée is situated in the north-east of the province of Limburg, close to the Bois-le-Duc Maestricht Canal; it has only about 1,700 inhabitants, but the outlying villages bring the population of the district up to nearly 4,000. In order to bring home to the people the advantage of electric lighting, circulars were issued showing in plain language its relative cost contrasted with oil lamps, the result being sufficiently satisfactory to enable the authorities to carry their projected electrical undertaking into effect.

Russia.—According to the *Mining Journal*, *apropos* of recent announcements of fresh discoveries of gold on the Lyamur, near Nikolaieffsk (Far East), an imposing programme of gold exploitation on the Amur is set down for the coming open season, when the Ochotsk Co.'s gold mines, which are said to have been leased to the English Orsk Co., will be exploited on a large scale by means of electric dredges. On the right shore of Lake Shyla, about eight miles away from the mines, a station will be built.

Cuba.—Senor Antonio Ramos Valderas has been authorised to establish in Sancti Spiritus an electric generating station with the object of supplying electric energy to the town of Sancti Spiritus and the districts of Zaya del Medio, Cabaiguán and Guayos. Senor A. G. Bornsteen also is to establish an electric generating station in Güira de Melena, Province of Havana.—*Board of Trade Journal.*

Darwen.—The Corporation has entered into arrangements to supply electric power for an extension of Hillside Mill. There is also a possibility that at least one of the new mills being erected in the town may be similarly supplied.

Doncaster.—The T.C. has decided to carry on experiments in public lighting with electric and gas lamps, before definitely deciding upon a scheme.

Dover.—The War Office has applied to the T.C. for a reduction in the price asked for a supply of current to buildings on the Eastern Heights, for which a rate of 4d. per unit is asked.

The Council has decided to offer a reduction of ½d. per unit on the terms offered.

Dundee.—On the new dock quay to be constructed at Dundee, the cranes will be electrically operated. It is proposed to have eight travelling cranes each with a lifting capacity of 30 cwt., and one travelling crane with a lifting capacity of 5 tons, the power for these cranes being supplied from the Corporation electric power station. It is also under consideration to erect a 120-ton crane for the service of shipbuilders and engineers, at a cost of £15,000 for the crane, and £5,000 for foundations.

Dunoon.—After spending over £40 on a deputation to the B. of T. in order to get an extension of time in which to carry out the Electric Lighting Order (1906), the T.C. has decided by six votes to five to allow the order to drop. The B. of T., it will be recalled, was willing to grant an extension of a year, but the Council wanted a longer period.

Frome.—At the monthly meeting of the U.D.C. on Monday, the Clerk reported that the B. of T. had now approved of the draft deed of agreement for the transfer of the electricity works to Messrs. Edmundson, and that the document would be ready for sealing during the present month.

Iceland.—The great waterfalls in which Iceland abounds lie mostly far from the coast and from the inhabited districts, which is the reason why they have up to the present remained unutilised. Quite lately, however, a French company has purchased a tract on the south coast near Thorlakshavn and also several large waterfalls in the uplands. These are of an estimated aggregate capacity of 200,000 H.P. and it is intended to construct a good port and work the factories to be erected there by electricity. A beginning is to be made with a factory for the manufacture of nitrogen by the Birkeland-Eyde process.—*Elektrotechnische Zeitschrift.*

Isle of Wight.—Mr. Wm. H. Marshall, consulting engineer, of Southsea, has been appointed by the Isle of Wight Central Railway Co. to prepare a scheme for electric light and power at their workshops, stations and wharves, including a complete scheme of electric cranes and electric capstans and locomotives for shunting trucks at the Madeira Wharf, Cowes.

Itchen.—Electricity supply matters at Woolston, near Southampton, have been advanced a further stage by the appointment at the last meeting of the U.D.C. of Messrs. May & Hawes, consulting engineers, to draw up a scheme for the establishment of an electric supply undertaking for the district.

Lancaster.—The T.C. has reduced the price of energy for private lighting from 4½d. to 4¼d. per unit.

Llanfairfechan.—The U.D.C. has decided to engage an expert to report on the feasibility of lighting the district with electricity, and the cost thereof.

L. & N.W. Railway Bill, 1912.—We are informed that in consequence of the widespread opposition, Clauses 34 to 37 in this Bill will be withdrawn by the promoters when it reaches the Committee stage.

London.—Hammersmith.—The Electricity Committee has decided to enter into an agreement with the Notting Hill Engineering Co. for the supply of current for lighting purposes, and for the driving of the whole of the company's machinery. This agreement is subject to the company being charged, as a consumer whose accounts for power supplied amount to over £100 per annum, 1½d. per unit less 33⅓ per cent. discount for energy for both power and lighting purposes provided that the amount of energy used for lighting and charged at the rate mentioned shall not exceed 20 per cent. of the total consumption per annum. In order to comply with the requirements of the L.C.C. as to the provision of six testing stations, the Committee has decided to use the Council's underground sub-stations for the purpose, and to purchase the necessary recording instruments at a cost not to exceed £225.

Hackney.—The Finance Committee reports that the estimated surplus on the electricity undertaking for the year ending March 31st, 1912, will amount to £8,098, and that, in view of the substantial amount standing to the credit of the reserve fund, it has decided that for the half-year ending March 30th next £1,992 of the above-mentioned surplus shall be allocated to the credit of the general rate account, and that the balance of the profit for the current year be allocated to the credit of the general rate for the half-year ending March 31st, 1913. An expenditure not to exceed £80 has been authorised for the installation of six recording voltmeters and the provision of a standard voltmeter and recording leakage indicator (to be obtained from Elliott Bros. at a cost of £69 5s.), including the necessary fixing and connections, in order to comply with the requirements of the L.C.C. to establish testing stations for recording the pressure of supply.

Camberwell.—A letter has been received by the B.C. from the B. of T. in connection with the Camberwell Electric Lighting Order, 1896, to the effect that the company had agreed when rendering its accounts for 1911 that it would remove from those of the Camberwell undertaking the item of £24,512 which had been charged to those accounts for many years under the heading of "Machinery." By this arrangement the Board hoped the litigation between the Council and the company would be satisfactorily concluded. A reply is to be sent to the effect that the Council notes with satisfaction the striking-out of the machinery item, and asking the Board to require the company to furnish the Council with detail particulars of the items amounting to nearly £12,000 charged to capital account and having reference to the purchase of lands.

Hornsey.—At the last meeting of the Council, Councillor Double asked why it was that the estimated surplus of the undertaking for the year ending March 31st, 1913, was only £1,025, as against £1,738 for the 12 months ending March, 1912. In reply, Councillor Moritz said that the decrease was partly due to the increased cost of loans, and partly to alterations to arc lighting, which come out of revenue. At the same meeting it was decided to defer the matter of reducing the flat-rate charge. An amendment was moved by Alderman Wilson referring back the report, with a recommendation that the matter should be reconsidered in the autumn. In round figures, he said, they made last year £2,000 profit out of private consumers, which he considered too much. A charge of 4½d. instead of 5d. per unit would help the undertaking considerably. This amendment was, however, negatived, as was also a further amendment to reduce the flat rate to 4¾d.

A conference has taken place between the B. of T. and representatives of the electric supply companies in London, to consider questions arising out of the strike, such as fuel supply and street lighting.

Marylebone.—The general manager of the undertaking (Mr. A. H. Seabrook) reports a satisfactory increase in the sale of energy during the December quarter, the total number of units sold being 4,449,078, as against 4,112,087 for the corresponding period in 1910. Taking the gross income from the sale of energy to consumers and meter rentals, they had a total of £60,460, as against £57,890 in the previous year. The expenditure for the quarter amounted to £15,829, as against £12,386 in 1910.

Loughborough.—The T.C. has approved of the proposed agreement with the Brush Electrical Engineering Co. for supply to it of all the power required for the works, subject to certain minor alterations asked for by the company. The guaranteed minimum consumption is 1,250,000 units per annum, and the T.C. has agreed that in the event of the company not using the minimum (for which it has to pay) in one year, the units so paid for may be deducted from the excess over the minimum in the two following years. The Council also agreed to retain Mr. J. F. C. Snell as consulting engineer in connection with the proposed extensions of plant.

Malling.—The R.D.C. has assented to current being supplied to premises at Allington, including the Castle, by the Maidstone T.C.

Nelson.—The Electricity Committee has resolved, and the T.C. has confirmed the recommendation, that application be made to the L.G.B. for sanction to borrow £3,000, the sum estimated to be required during the next four years for mains and services, including £757 already expended.

Newport (Mon.).—The T.C. has arranged to supply electricity for power to the Cardiff Dry Dock Co., who have taken over the Tredegar Dry Dock. This will mean a demand for energy costing from £600 to £1,000 a year.

Nuneaton.—An inquiry has been held by the L.G.B. into the T.C.'s application for sanction to borrow £7,000 for new plant in connection with the electricity undertaking. There was no opposition.

Oswestry.—The Corporation has decided to have electric light installed in the Council chamber.

Rochdale.—The gas and electricity workers have written to the T.C. asking for an increase of wages. The wages of the ordinary labourers at the Gas and Electricity Works have been 5½d. per hour for a 55½ hours' week, which works out at 25s. 6d. weekly. The Union asked for an advance of ½d. per hour, which would represent 27s. 9d. per week. The Council in committee on the 7th inst. decided to grant an increase of 6d. per week, making the wages 26s., which, it is believed, will be accepted.

Runcorn.—The U.D.C. has resolved that electric pumping be substituted for the present steam plant at the Waterworks. It is estimated that the cost of pumping by electricity will be 1·26d. per 1,000 gallons as compared with 2d. at present. The Council has decided to proceed with the work of laying new and enlarged mains at a total cost of £2,000.

St. Helens.—The Electricity Committee of the T.C. has entered into an agreement to supply electricity for 10 years to the Greengate Brick and Tile Co., for an annual payment of £400. A scheme to supply the Parr district is to be prepared.

Sheffield.—The Corporation E.L. department, which recently found its output for motor-driving going up by leaps and bounds owing to the emergency adoption of electric driving in works which were short of coal, and which considered the question of restricting the supply, has made a "find" of 3,000 tons of coal, and so will be able to avoid the threatened curtailment of supply to power users.

Stretford.—The Electricity Committee has received an application from the Stretford Gas Co. for a supply of electricity, and has decided to give this at a flat rate of 1½d. per unit net subject to a minimum consumption of 25,000 units per annum for a period of five years.

Stourport.—The B. of T. has informed the U.D.C. that it has revoked the E.L. order of the Kidderminster and District E.L. Co., so far as it relates to the Council's area. As stated in a recent issue of the Electrical Review, the Council supported the revocation of the order.

Swindon.—The T.C. has applied to the L.G.B. for a loan of £6,500 for the provision of a Diesel generating set at the electricity works.

Torquay.—The T.C. has decided to apply for a loan of £7,000 for mains extensions.

By a reduction in the price of energy, power consumers are to be supplied at a maximum price of 1½d. per unit net. Private consumers who have at least six 30-watt lamps connected, or whose premises are electrically lit throughout, are to be supplied with energy for any purpose but lighting or motive power, at a flat rate of 1d. per unit.

Turton.—The U.D.C. has received from the L.G.B. sanction to a loan of £4,450 for electricity purposes, and the scheme is to be proceeded with forthwith. Current is to be supplied to private persons at 5d. per unit.

Uruguay.—The Government is pushing forward its project for the nationalisation of all the electric power houses. The directors of the Montevideo electric power house have been instructed to prepare a report on all existing stations, and also the towns which have not got electric lighting. Tenders will be called for the erection and equipment of the new works.—*Review of the River Plate.*

Wednesbury.—The Corporation has decided, as an experiment, to light the lamps in the Market Place by electricity until the end of December.

Wimbledon.—The Electric Lighting Committee has decided to appoint sub-committees to consider the advisability of providing additional generating plant, and coal hoppers and conveying plant, at the electricity works. Sanctions have been received from the L.G.B. to the borrowing of £505 for cables laid in ducts, £1,515 for cables laid direct in ground, and £850 for transformer sub-stations and equipment.

Winchester.—The T.C. is recommended to light electrically 36 public lamps, at a cost of £2 13s. 3d. each per annum.

Wolverhampton.—The sum of £2,125 is to be transferred from the profits of the Corporation electricity undertaking for the year ending March 31st, 1912, to the credit of the improvement fund.

TRAMWAY and RAILWAY NOTES.

Bradford.—In a special report on the subject of ½d. fares, Mr. C. J. Spencer, general manager of the city tramways, is very hostile to the institution of any fares less that 1d. The 1d. fare, says Mr. Spencer, is the mainstay of the city's tramway undertaking and the source of the profit. After extensive inquiries, he reports that though not prepared to recommend a universal 1d. fare within the city as yet, he thinks the time may come when that would be practicable. Mr. Spencer is also strongly opposed to cheaper workmen's fares and passes. There is, however, considerable outcry in the city for cheaper fares for the short distance traveller.

Brazil.—The British Vice-Consul at Sao Joano d'el Rey reports that some local capitalists have under consideration the formation of an electric tramway company. As, however, the existing supply of electric power is insufficient for this purpose, it would be necessary to make a new dam and to install new turbines at the falls of Carandahy. The estimated cost is about £6,600.—*Board of Trade Journal.*

Birkenhead.—The T.C. has decided to purchase six new cars for the New Ferry route, at an estimated cost of £4,404. Each car will hold 80 passengers.

Burton-on-Trent.—The Tramways Committee has decided to expend £6,492 on track maintenance during the next five years.

Canada.—With a snowfall of 11 in. one night recently, the Ottawa street cars were very little delayed; 13 "sweepers" were constantly employed, which kept the tracks free of snow. When cars first started in Canada they did not run at all in winter, as it was thought impossible to keep the tracks clear of snow. Ottawa was the first city to use "sweepers," which proved a complete success. Now deep snowfalls have no terror for the cars.

Continental Notes.—Germany.—The proposed conversion by the Government of Baden of various subsidiary railways to electric traction has advanced a stage towards realisation. Among these is the Wiesental railway, which proceeds from Basle, *via* Lorrach to Schopfheim and Sackingen. The power is to be supplied by the hydro-electric works near Augst-Wyhlen, which is being built jointly by the town of Basle and the Rheinfelden Co., and is to be completed in a few months. The conductor network for the Wiesenthal railway has already been finished, and the working of the line is expected to be begun this year. The second State railway to be transformed is the Murgtal line, which connects Rastall with Forbach *via* Germsbach. It is proposed to erect a State power station at a cost of £750,000 on the Baden-Wurtemberg frontier, in the vicinity of Raumunzach for the operation of the railway and for other purposes.

Russia.—The city of Moscow intends, in the course of the present year, to raise a loan of 37,000,000 roubles for various public works, including the electric conversion of street tramways, enlargement of the power station, and increase of the rolling stock. For the latter purposes 7,900,000 roubles are allocated. The first four years' working of that portion of the city's tramways already electrified have given the most satisfactory results, the income having steadily risen from year to year.—*Elek. u. Maschinenbau.*

Italy.—Plans are being prepared in respect of a projected electric tramway to connect the towns of Foggia and Lucera.

France.—A scheme for the electrification of the Paris suburban railways on the Ouest-Etat system is again under consideration. Among the lines it is proposed to electrify are those running from the Gare St. Lazare, Paris, to Auteuil, Issy, Versailles, St. Germain and Argenteuil.

Spain.—A concession has recently been granted in respect of a projected light electric railway between Renteria and the French frontier.

Denmark.—Negotiations are pending between the city authorities of Aalborg, in Denmark, and the Allmanna Svenska Elektriska Aktiebolag for the establishment and working of an electric tramway system which will be supplied with continuous current from the municipal station.

Crewe.—The electrical engineer to the Corporation has been instructed to submit a report as to the cost of providing additional plant at the electricity works necessary for a service in the borough of four cars on the railless trolley system, and to obtain the latest information from Leeds and Bradford as regards cost of running and installation, with the extra cost (if any) entailed in road maintenance consequent upon the use of railless cars. Information is also to be obtained as to the initial outlay, upkeep, and general expenditure on four motor-'buses.

Dundee.—On the ground that the cost of living has risen, the Corporation tramway men have made application for a wage increase of 2s. all round, and Mr. Peter Fisher, the manager, has been asked to report as to wages and conditions in other centres.

Lanarkshire.—It was stated at a meeting of Cambuslang P.C., that as a result of a petition signed by 600 householders in the Halfway district for a better service from the Lanarkshire Tramway Co., Mr. Moller, the general manager, is to lengthen the ½d. stages, and to put on additional cars.

London.—The *Financial News* says it is frankly acknowledged that efforts are being made to bring the Metropolitan and Central London Railways within the District-Underground-L.G.O.C. combine. The chief purpose of the arrangement is said to be reduced operating expenses and greater efficiency.

The L.C.C. is to sell the portion of the Highgate Hill tramways in Hornsey, to the Middlesex C.C., for £6,377. A 30 years' agreement is to be entered into by the L.C.C. for working the route, at a yearly rent of £357.

Manchester.—In submitting the minutes of the Tramways Committee at the T.C. on the 6th inst., Alderman Bowers, chairman, asked the Council to confirm the Committee's proposal to rescind the resolution relating to the acceptance of a tender of an American firm (the Lorain Steel Co., of Johnstown, U.S.A.) for the supply of steel tramway rails, and that in lieu thereof the tender of Messrs. Walter Scott, Ltd., of Leeds, be accepted for the supply of 3,250 tons of steel tramway rails manufactured in accordance with the Sandberg process, at the price of £7 5s. per ton. The Council agreed. It was stated that the American rails were in every way suitable and would have cost between £2,000 and £3,000 less, but that they could not be delivered in time.

Walsall.—The net profit on the Corporation's tramway undertaking for the past year has amounted to £1,575, and it is proposed by the Tramways Committee that this shall be carried to the reserve fund, which will then total £29,956.

West Ham.—The Sub-Committee appointed to negotiate with adjoining authorities respecting tramway matters in the Council's Bill in Parliament reports that, in connection with lighting of the tramway route of the proposed extension to Wanstead, it has agreed to bear the cost of such lighting subject to the Wanstead Council agreeing to pay £37 10s. per annum towards such cost. With regard to the section relating to railless cars, and to the request of the Wanstead Council that such clause should be withdrawn from the Bill, it has decided not to accede to this, but, in lieu thereof, negotiations should be carried on with a view to an amendment of the clause being made providing that the power to run such vehicles should not be exercised in the Wanstead area without the consent of that authority.

Wolverhampton.—It has been decided to transfer £3,777 from the profits of the Corporation's tramway undertaking to the credit of the borough fund.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephone Service.—An agreement regulating the telephone service between the United Kingdom and France was signed on February 5th, and was published last week. The charges will depend upon the situations of the centres in communication, and will range from 2 fr. 50 to 7 fr. 50, the latter fee being charged for communication with Scotland or Ireland.

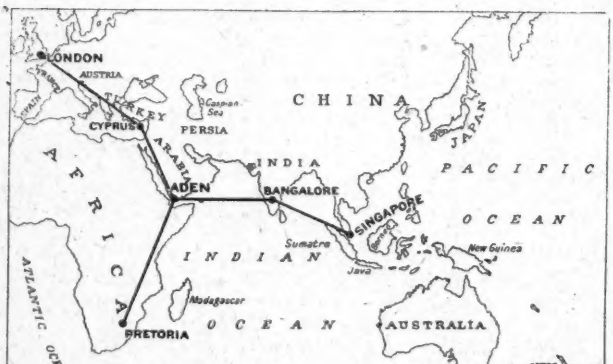
Attendance at Telephone Exchanges.—The Post Office has issued a statement to the effect that it was the National Telephone Co.'s practice to refuse to open small exchanges in country districts unless the number of minimum subscriptions at £6 for measured-service, or £8 for residence unlimited-service, was sufficient to cover the cost of attendance at night as well as during the day, or unless subscribers would pay higher rates. The Post

Office has opened many small exchanges in recent years in districts not served by the company for small groups of two or more subscribers at the minimum measured-service rate of £5 a year. In a comparatively few cases the only premises available are not occupied at night, but when night attendance is available small disturbance fees for the occasional night calls have been charged to prevent an increase in the loss incurred in providing day service. At all new exchanges the conditions offered to subscribers will include continuous service.

Australia.—The Postmaster-General has decided to commission Mr. J. Hesketh, chief electrical engineer to the department, to make a tour of the world for the purpose of learning the latest improved methods of dealing with large bodies of business, giving special attention to means adopted in the United States and Europe, and particularly with respect to automatic telephones and telegraphs. Pending the receipt of Mr. Hesketh's report, the new switchboard for Perth will be held back.—*Australian Mining Standard.*

Compulsory Wireless Installations.—According to the *Marconigraph*, the Spanish Government has decreed that from August 1st, 1912, all vessels carrying passengers or mails, or more than 50 persons on a trans-Atlantic voyage, shall be equipped with wireless telegraphy.

Imperial Wireless Telegraph System.—The Postmaster-General has accepted the tender of Marconi's Wireless Telegraph Co., Ltd., for the construction of all the long-distance wireless stations required for the first section of a comprehensive scheme embracing the whole Empire. The British and Colonial Governments have decided to proceed with the erection of stations at London, Egypt, Aden, Bangalore (India), Pretoria, and Singapore, at a cost of £60,000 each, exclusive of site, foundations and buildings. The Marconi Co. will operate the stations on behalf of the Government for the first six months, and will receive 10 per cent. of the gross receipts of all the long-distance stations for a period of 28 years from the completion of the first six stations. The Government, however, may terminate the agreement at the end of 18 years, in which event they will cease to have the right to use any of the company's patented processes or apparatus. The establishment of these stations will lead to the erection of others



in adjacent countries, and will thus tend to increase the traffic, and it is anticipated that their operation will reduce the rates now charged for telegraphic communication with and between the Colonies. A further advantage is that the Admiralty will be able to communicate quickly with the Fleet in almost any part of the world this side of Hong Kong. The accompanying map indicates the positions of the new stations, except that Egypt will be substituted for Cyprus. Australia and New Zealand are, providing their own stations, and will thus come into the chain while towards the west there is already a network of some 24 stations on British territory, besides the new Spanish stations and others in communication with Clifden and Poldhu. As regards the Australian stations, those at Melbourne and Sydney are ready, and one at Perth is nearly complete; others are to be erected at Hobart, Brisbane, Adelaide, Port Moresby (Papua), and Thursday Island. The present contract, which requires Parliamentary sanction, will probably be completed in 12 months.

Guernsey Telephones.—The revenue statement for the year ended December 31st, 1911, shows that working expenses amounted to £1,919, office and general expenses to £2,502, and depreciation and sinking fund payments to £1,813, making a total of £6,234; the revenue from all sources was £6,727, leaving a net profit balance of £493. The mileage of overhead wire (double) increased by 46 to 1,356 miles; underground wires remained practically stationary at 823 miles. The total number of calls was over 1¼ million, averaging 2·2 per day per subscriber and 5 per day per public telephone. There were 1,628 subscribers' lines and 62 public telephones. The total capital expenditure amounts to £44,324, and the sinking-fund repayments to £2,174. The reserve funds for depreciation and contingencies amount to £15,804, but of this £11,352 has been expended on construction work; to replace the latter sum, £740 has been placed in a special sinking fund. The net reserve, therefore, amounts to £5,192. The loan of 1905 was £32,000, of which £2,714 has been repaid.

The World's Cables.—Some interesting statistics regarding ocean cables are supplied by the *Elektrotechnische Nachrichten*. Germany possesses at present four cable companies. The Deutsch-Atlantische Telegraphen-gesellschaft owns two cable lines to America and one to Vigo, in Spain; the network has a length of 17,728 kilometres. The Deutsch-Americanische Co. has 10,718 kilometres of cables. The Deutsch-Nederländische Co.'s cable in the South Sea (Menado-Jap-Guam-Shanghai) has a length of 6,336 kilometres, and, finally, the Osteuropäische Co.'s cable between Constantza (in Roumania) and Constantinople has a length of 343 kilometres. In the aggregate these four companies, whose headquarters are in Cologne, control a network of 35,122 kilometres. The two French companies have a total cable length of 51,959 kilometres; the six American, 62,888 kilometres. In London are the seats of 18 English cable companies, which control a network of 241,327 kilometres. The English network is thus seven times the size of the German. The largest English company, the Eastern Telegraph, alone possesses 75,932 kilometres of cable. Two other companies, the Eastern Extension, Australasia and China Telegraph Co., and the Western Telegraph Co., have each networks 44,000 kilometres in extent. English pre-eminence is, therefore, overwhelming. The United States and France are pushing vigorously ahead. It is, says our contemporary, to be hoped that Germany will not rest satisfied with past exertions, but will continue to extend her cable network.

Telephone Rates Abroad.—In reply to a question in the House of Commons, the Postmaster-General stated that in Austria the unlimited-service rate for areas with more than 20,000 subscribers was £16 13s. a year. In Germany, the corresponding rate was £9, but the German Administration had stated that this rate was very unremunerative in the case of large users. In Switzerland all telephone service was given on a measured-rate basis. In New York the telephone service was given entirely on a measured-rate basis, and the unlimited-service rates were exceptional in other large cities. In Chicago and Boston these rates were about £26 a year. In London the unlimited-service rate was £17 a year, but this covered calls to distant parts of the area, which, in other countries, would be regarded as interurban or trunk calls, and for which special fees would have to be paid. Outside London, although there were many agreements in force at the obsolete unlimited-service rate of £10 a year, there had been no current unlimited-service rate for business connections since 1907, but for private residences there was still an unlimited-service rate of £8 a year.

Telephones and Infection.—As a result of renewed bacteriological investigations, the P.M.G. has announced that the transmission of tuberculosis through the medium of the telephone mouthpiece is practically impossible. This confirms the conclusions arrived at on previous occasions.

Turkey.—The telephone network of Constantinople, now under construction, is designed for 10,000 subscribers, but this figure may be raised to 18,000. To business houses the yearly charge for 550 conversations will be 137·5 fr. Private residents will pay 200 fr., and 20 centimes additional per conversation from one town to another. The network, the cost of which will be about £125,000, will, it is expected, be completed in about 20 months.—*L'Industrie Electrique.*

West Indies.—The Colonial Secretary has informed the Acting-Governor of British Guiana that the proposals contained in the report of the Royal Commission on Trade Relations between Canada and the West Indies, regarding the acquisition by the State of the cables owned by the companies operating in the West Indies, the duplication of cables, and the provision of wireless stations, cannot be carried out. He favours the erection of wireless stations by the local Governments where possible.

Wireless Ocean Post.—The Deutsche Betriebsgesellschaft für drahtlose Telegraphie has inaugurated a kind of ocean post of much service to travellers. The passenger on a boat, say from Lisbon to Rio, writes his letter on an ordinary telegram form and hands it to the telegraph official on board, who immediately wires it to the nearest ship going in the desired direction. The receiving ship records the message on a special form and encloses it in an envelope which is posted on arrival at port. The sender of the ocean letter is thus able to communicate with his correspondent in half the time he would have been able to do had he waited till he arrived at his destination. The cost of these ocean letters is five marks 30 words, plus 50 pfennigs for postage.—*Elek. u. Masch.*

The Blackpool tower, 500 ft. in height, is to be made a wireless station during the encampment of the West Lancs. Division of Territorials, near Blackpool, in August.—The *Marconigraph.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—March 23rd. Stores for the Tramways Committee for a year. H. Pilling, general manager.

Australia.—Victoria.—April 2nd. 250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 2nd.—10,000 metal-filament lamps, for the Melbourne City Council. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" March 1st.

April 23rd.—2000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

Queensland.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" to-day.

Western Australia.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

Austria-Hungary.—Banjaluka (Bosnia).—April 10th. Tenders are invited for the erection complete of a hydro-electric station on the Urba River, for the supply of light and power to the city and suburbs. Only tenders for the complete installation will be considered. Terms, 15 kronen, of the municipality. Deposit 20,000 kronen. Offers, with the superscription "Offert zur Zahl 1,146 für die Elecktricitätsanlage," to be addressed to the Stadtmagistrat, Banjaluka.—*Elek. u. Maschinenbau.*

Belfast.—April 8th. Two 750-kw. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices." March 8th.

Belgium.—April 1st. La Direction du Service Special d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels, is inviting tenders for the mechanical and electrical equipment of ten pumping stations in connection with the Charleroi Canal.

Bray.—March 19th. Stores, for the U.D.C. Electricity Works. See "Official Notices" March 8th.

Brighouse.—March 18th. 1,220 yd. of armoured cable, one feeder pillar and one feeder panel, for the T.C. See "Official Notices" March 8th.

Bristol.—March 28th. Separate tenders for the following, for the Guardians, for Southmead Workhouse:—(2) Boilers, economisers, steam pipes, &c. (deposit £5); (3) electric light generating plant; (4) electric light wiring and fittings; (5) laundry machinery, motors and appliances. Deposits for 3, 4 and 5, £2 each. J. J. Simpson, Clerk to the Guardians, St. Peter's Hospital.

Canada.—Calgary.—March 20th. City Commissioners. One 2,500-kw. turbo-generator set, one 1,000-kw. synchronous motor-generator, 50-kw. motor-generator and 25-kw. exciter set. Deposit £500. Particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

March 30th.—One 1,500-kw. A.C. steam turbo-generating set, and one 500-kw. A.C. generator coupled to Diesel engine, for the City Commissioners of Moose Jaw, Saskatchewan. See "Official Notices" March 8th.

Saskatoon.—March 22nd. Water-tube boilers, induced draught plant, economisers, automatic stokers, steam feed pumps, one 2,000-kw. steam turbo-generator, turbine exciters, &c. Specification can be seen at the Commercial Intelligence Department, Board of Trade, London. Tenders to City Commissioners, Saskatoon, Saskatchewan. Deposit five per cent.

Cape Town.—April 24th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

Cardiff.—March 21st. Electric light sundries, for a year, for the City of Cardiff Mental Hospital, Whitchurch. Clerk and Steward of the Hospital.

Edinburgh.—March 23rd. Arc lamp globes, cast-iron pipes and pavement boxes, and underground conduits, for the Electricity Department. Deposit 10s. Mr. F. A. Newington, engineer.

France.—Paris.—March 21st. Supply and installation of six groups of electric pumps at the municipal waterworks on the Quai d'Austerlitz. Particulars, Ingenieur-en-chef, Service technique des Eaux et de l'Assainissement, 9, Place de l'Hôtel de Ville, Paris.

March 21st.—The municipal authorities of Moisy-le-Sec (Seine) are inviting tenders for an installation of electric lighting in the Town Hall.

Gillingham.—March 25th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" March 8th.

Govan.—March 26th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

Greece.—Piræus.—March 31st. Three electric cranes of 10, 6 and 2 tons respectively for the Harbour Board. Com. Int. Dept., Board of Trade, London.

Halifax.—March 26th. Electrical fittings, for six months, for the Board of Guardians. A. T. Longbotham, clerk, Carlton Street.

Hornsey.—March 16th. Extension of dynamo and feeder switchboard, for the T.C. See "Official Notices" March 1st.

Kingston-upon-Hull.—March 26th. Extra-high-tension three-phase switchboard, and 20-ton overhead travelling crane, for the Corporation. See "Official Notices" March 8th.

London.—L.C.C.—Tenders are to be invited for two new engines for driving the mechanical stokers, coal conveyors, &c., at the Crossness pumping station.

March 26th.—Electrical installation at the Morden Terrace School. See "Official Notices" to-day.

Kensington.—March 28th. Telephone installation at the Infirmary in Marloes Road. Clerk to Guardians, at the Infirmary.

Woolwich.—March 20th. 1,200-kw. three-phase turbo-alternator, with condensing plant, for the B.C. See "Official Notices" March 8th.

H.M. Office of Works.—March 26th. Carbon and metal-filament lamps for one year. See "Official Notices" to-day.

Bethnal Green.—April 2nd. Telephone cables, for the B. of G. See "Official Notices" to-day.

Merthyr Tydfil.—March 28th. Electrical installation at the Municipal Secondary School, Cyfarthfa Castle. See "Official Notices" March 8th.

New Zealand.—May 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

Rhodesia.—Salisbury.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting London Agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

Rosario.—The *Review of the River Plate* says it is reported from Rosario that the municipality will shortly call for tenders for the extension of the electric tramways. Several firms are said to be interested in the business.

Russia.—In the course of the present year the Russian Postal Ministry intend to establish on the shores of the Arctic four wireless stations. Three stations will be fitted with ordinary apparatus, while the fourth will have a specially powerful equipment. The cost is estimated at 230,000 roubles. Tenders are to be called for. Further particulars may be had from the Ministry of Posts and Telegraphs, St. Petersburg.—*Elek. u. Masc.*

Salford.—March 21st. Main D.C. lighting and power switchboard, for the Corporation. See "Official Notices" March 8th.

Electric, telephonic, and fire alarm installations at the Infirmary, for the Board of Guardians (over £2,000). Lacey & Sillar, engineers.

Sweden.—March 31st. The Electro-technical Department of the Stockholm Municipality are inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). For further particulars, see this column for March 1st.

Tonbridge.—March 18th. Cables, meters, arc lamp carbons, &c., for a year, for the U.D.C. H. W. Peach, clerk, Tonbridge Castle.

Walthamstow.—March 22nd. Water-tube boilers, feed pump and pipework, turbo-alternators or engine-driven alternators, motor generators, rotary converters and switchgear, for the U.D.C. See "Official Notices" March 8th.

West Hartlepool.—April 2nd. (*a*) 300-kw. storage battery and booster (*b*) rotary converting plant, for the Corporation Electricity Department. See "Official Notices" to-day.

Wigan.—March 25th. Stores and materials for the Corporation Electric Light and Tramways Departments. See "Official Notices" to-day.

CLOSED.

Australia.—The following contract acceptances are notified in the *Australian Mining Standard*:—

Victoria.—P.M.G.'s Department.—100 common-battery table telephones, at £2 6s. 4d. each. 10,000 protectors at 3s. 4½d. each. 80 miles of telephone cable, 208 pairs conductors at £494 per mile.—Western Electric Co. (Aust.), Ltd.

Queensland.—P.M.G.'s Department.—Condensers, relays, resistance boxes, sounders, switches, &c.—British Insulated and Helsby Cables, Ltd.

20 spring inkwriters, at £16 11s. each; 20 sounders, Morse P.O. pattern, at £1 6s. each.—Siemens Bros. Dynamo Works, Ltd.

55 keys, platinum wire, relays, transmitters, &c.—I.R.G.P. and T. Works Co., Ltd.

Belgium.—La Société des Ateliers de Constructions Electriques, of Charleroi, last week submitted the lowest tender to the Belgian State Railway authorities in Brussels for the supply of a 25-ton electric travelling-crane. Three others firms competed for the order.

Birkenhead.—The Corporation has accepted the tender of Messrs. Siemens Bros.' Dynamo Works, Ltd., for six tramcars, for £4,404.

Burnley. — The Electricity Committee has accepted Messrs. Siemens Bros.' tender for lead-covered paper-insulated cable required for the tramway extension to Harle and Syke.

Blackburn.—The T.C. has accepted the following tenders for the electricity works :—

The Micanite and Insulators Co., Ltd.—Micanite sheet, red fibre sheet.
R. W. Blackwell & Co., Ltd.—Insulating paint, P. & B. insulating tape, Kurkee insulating tape.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—India-rubber solution, self-adhesive compound tape.
Siemens Bros. & Co., Ltd —Plain linen tape.
Vacuum Oil Co., Ltd.—Crank-chamber oil, cylinder oil.
Electrical Apparatus Co.— Motor-starting switches.

Bury.—The Corporation has accepted the tender of Messrs. Ferranti, Ltd., for high-tension switchgear.

Lexden and Winstree.—The B. of G. received the following tenders for installing the electric light at the workhouse :—

Williams & Co., Colchester..	(accepted)	£127
Joslins, Ltd., Colchester		185
Mr. Peacock		146

Liverpool.—Tenders for the supply of materials to the electric supply department for 12 months have been accepted by the Corporation as follows :—

Cables and accessories for street mains.—Callender's Cable and Construction Co., Ltd.
Wood casings and sundries.—P. L. Jones & Co.
C.I. troughs and boxes.—Whyman's Foundry Co., Ltd.; J. Allan, Sen., and Son, Ltd.; and E. Wilson & Co.
Carbon filament lamps.—Electrical Co., Ltd.
Insulated cables and wires.—Anchor Cable Co., Ltd.; British Insulated and Helsby Cables, Ltd.; and Ward & Goldstone.
Carbons for arc lamps.—Wm. Geipel & Co.; General Electric Co., Ltd.
Brass and copper castings.—R. Roberts & Sons.
Electric fittings and sundries.—Sykes & Sugden; British Insulated and Helsby Cables, Ltd.; and Edison & Swan United Electric Light Co., Ltd.

The Corporation has accepted the tender of Messrs. R. Wearing and Sons, West Derby, Liverpool, for work and material required in connecting up the high-tension switch-rooms at Nos. 1 and 2 stations, and the erection of the tanks for the new Worthington cooling towers at the Lister Drive power station, the amount being £2,967.

London.—HAMMERSMITH.—The following are recommended for annual contracts for the Electricity Department :—

Arc lamps and globes.—City Glass Co. (five tenders submitted).
Metal-filament lamps.—General Electric Co., Ltd. (Osrams), £188 (15 tenders for lamps of English manufacture; five foreign).
Electrical goods.—Veritys, Ltd. (seven tenders).
Meters (ordinary).—Ferranti, Ltd. (eight tenders).
Meters (prepayment).—Ferranti, Ltd. (six tenders).
Insulated wires.—General Electric Co., Ltd., £138 (24 tenders).
Packing and jointing materials.—Hobdell, Way & Co. (11 tenders).
Tubes and screws.—Pryke & Palmer (seven tenders).
Joint boxes and connections.—W. Lucy & Co., £461 (four tenders).

The Committee has deferred the consideration of tenders for the supply of oils, cable ducts, and conduits and fittings, and does not recommend the acceptance of any tender for carbon-filament lamps or for carbons.

The Westinghouse Brake Co., Ltd., of London, manufacturers of the Westinghouse-Morse rocker-joint chain, have just received from the Port of London Authority what is thought to be the largest single order for chain drives on record in this country, viz., eight drives aggregating 880 H.P. Further progress has been made in the manufacture of these chain drives, which are now made in various pitches up to 3 in. A ten-page booklet of illustrations just issued relating to the system, shows, among other things, an illustration of 3 in. and ½ in. links.

Manchester.—The Corporation has accepted the tender of Messrs. W. Scott, Ltd., Leeds, for the supply of 3,250 tons steel tramway rails, manufactured according to the Sandberg process, at £7 5s. per ton. The Tramways Committee had previously decided to accept the tender of the Lorain Steel Co., Johnstown, U.S.A., but the latter could not deliver in May. The Committee therefore rescinded its decision, and accepted Messrs. Scott's tender.

Newport (Mon.).—The B. of G. on Saturday accepted the tender of Messrs. R. Alger & Sons, of Newport, for electric light fittings.

Sheffield.—The following tenders have been accepted by the T.C. :—

Biennial supply of electrical fittings.—David Ashton & Co.; T. A. Ashton and Co.; Taskers, Sons & Co.; Renton, Holdsworth & Co.
36 high-tension switches.—A. Reyrolle & Co., Ltd., £392.
Two water-tube boilers, mechanical stokers, economiser and all accessories, at Shear Street power station.—Stirling Boiler Co., Ltd., £5,312.

Torquay.—The T.C. has accepted the tender of Mr. H. A. Bessemer, at £272, for wiring and installing electric light at the new pavilion.

Wolverhampton. — The Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for additional high and low-tension switchgear for the Chillington sub-station, at an estimated cost of £375. An additional transformer of not less than 300 KW. capacity is to be purchased and erected at the same sub-station, at an approximate cost of £250.

FORTHCOMING EVENTS.

Institution of Civil Engineers. — Friday, March 15th.—Students' meeting. At 8 p.m. Paper on "The Heat Value of Fuels," by Mr. A. E. Gladwin.

Junior Institution of Engineers.—Friday, March 15th. At 8.15 p.m. At 39, Victoria Street, S.W. Paper on "Crude-Oil Engines," by Mr. A. H. Weston.
Saturday, March 16th.—At 10 a.m. Visit to the Lot's Road power station, Chelsea.

Royal Institution.—Friday, March 15th. At 9 p.m. Discourse on "The Origin of Radium," by Mr. F. Soddy.
Saturday, March 16th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture IV.)
Saturday, March 23rd.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture V.)

Institution of Mechanical Engineers.—Friday, March 15th. At 8 p.m. Paper on "The Diesel Oil Engine, and its Industrial Importance, particularly for Great Britain," by Dr. R. Diesel.

South-Western Polytechnic.—Friday, March 15th. At 8 p.m. Distribution of prizes and certificates by Sir D. Gill.

Northampton Institute Engineering Society.—Saturday, March 16th (not March 9th, as stated in our last issue). At 7 p.m. for 7.30 p.m. At the Holborn Restaurant. Annual dinner.

Institution of Electrical Engineers (Students' Section).—Saturday, March 16th. At 7 p.m. At the Trocadero Restaurant. Eighth annual dinner.

Illuminating Engineering Society.—Tuesday, March 19th. At 8 p.m. At the Royal Society of Arts. Papers on "The Lighting of Printing Works and Offices," by Messrs. F. W. Goodenough and Justus Eck.

Institution of Electrical Engineers (Newcastle Students' Section).—Tuesday, March 19th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "High-Speed Radio-Telegraphy," by Mr. B. A. Robinson.

Institution of Electrical Engineers (London).—Thursday, March 21st. At 8 p.m. Discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes," to be opened by Mr. S. Z. de Ferranti.

Physical Society.—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A 2,000-Frequency Alternator," by Mr. W. Duddell; "A New Method of Comparing Capacities," by Mr. A. Campbell; and "The Coefficients of Cubical Expansion of Fused Silica and Mercury," by Mr. H. Donaldson.

Association of Engineers-in-Charge.—Saturday, March 23rd. At 6.30 p.m. At the Holborn Restaurant. Annual dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, March 18th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Tuesday, March 19th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.
Thursday, March 21st.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Friday, March 22nd.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.
Saturday, March 23rd.—Mobilisation week-end run at Fort Coalhouse for "D" Company. Parade at Fenchurch Street Station (L.T. and Southend Railway) at 3.10 p.m. Dress: Service dress, putties, greatcoats, belts and haversacks. No arms will be taken.
Saturday, March 23rd.—Annual course of musketry. The shoot arranged for this date is cancelled.
Shere.—The week-end run at Shere will be held on 23rd inst. for "A" and "B" Companies. Members wishing to attend please notify headquarters early. Time of trains, &c., will be notified by postcard.

(Signed) P. H. S. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

NOTES.

Parliamentary.—AGRICULTURAL LIGHT RAILWAYS.—Mr. Rowntree asked the President of the Board of Agriculture (1) whether his attention had been called to the development of agricultural light railways in Belgium and other countries since 1886, and whether he would be prepared to appoint a small committee to report as to what steps it would be necessary to take to establish in this country an effective system of agricultural light railways, and (2) whether his attention had been called to the small development of agricultural light railways under the Light Railways Act of 1896, and whether the commissioners appointed under that Act had reported to him as to the cause of the comparative failure of the Act to develop agricultural light railways in this country.

Mr. Buxton replied that the Board of Trade was fully acquainted with the position of light railways in Belgium and he did not think the appointment of a committee would serve any useful purpose. The Light Railway Commissioners had from time to time in their annual reports referred to the question of the comparatively slow development of agricultural light railways in this country, and he hoped that the Light Railways Bill which he had introduced would facilitate the promotion of light railway undertakings.

COMMITTEE.—A Select Committee consisting of Sir Luke White, Mr. J. E. Gordon, Sir C. Quilter and Mr. Millan has been appointed to consider the following Bills :—London Electric Railways, Edgeware and Hampstead Railway, Metropolitan District Railway and Ramsbottom U.D.C. Railway.

Metropolitan Electric Tramways Bill.—The *Times* reports that the order for the second reading of the Metropolitan Electric Tramways Bill, notices for the rejection of which stood in the names of six hon. members representing both sides of the House, was read in the House of Commons on 11th inst. and discharged, and the Bill withdrawn.

L.C.C.—London United Tramways Award.—According to the *Daily Telegraph*, the sum to be paid to the London United Tramways by the L.C.C. for the Company's tramways in the County of London, exclusive of any allowances for past or future profits, or any compensation for compulsory sale, or other consideration whatsoever, is £248,653, divided as follows:—

Permanent way and metals	£33,964
Overhead electrical equipment	2,803
Ducts, cables, and manholes...	8,941
Cars	21,125
Special Expenditure:—	
Deposit with Hammersmith B.C.	1,000
Proportion of payment to Treasury	1,359
Street widenings	35,462
Road lowerings	1,250
Parliamentary expenses	15,500
Chiswick depôt and power station	127,249
Total	£248,653

The L.C.C. is to pay the whole of the costs.

It may be pointed out, with respect to the item concerning the ducts, cables, and manholes, that the tramway company claim £10,437 instead of the £8,941 allowed. The company further maintain that they are entitled to a larger proportion of the payment of £10,000 made to the Treasury than the £1,359 awarded by the referee. They further claim £4,500 paid by them to the Fulham District Board, and another £1,000 paid to the same body.

In respect of the above items, the referee's award has been stated in the form of a special case, as has also his award with regard to the cost of street widenings and legislative expenses. Should the L.C.C. succeed in getting the award for the latter items set aside, the referee has determined that the Council shall pay, on behalf of the first item, £4,000 only, and with regard to the second item of £15,500 nothing at all.

Building Exhibition, Manchester.—Of the two Exhibitions at present open in Manchester, perhaps the one at the City Hall will appeal most to the electrical engineer. Progress is marked by the fact that practically all wood-working machines and tools are separately driven by electric motors. The tendency in all modern works is for a separate and electrical drive for every unit, and that this practice makes for highest plant efficiency is now well known. A distinct departure from ordinary practice is noted in the Marino electro-galvanizing process. Unlike the general method of coating iron with zinc, which consists of dipping the iron into a bath of molten zinc, the process is a cold one.

In the process, mineral acids are entirely eliminated, and by the use of an effective reducing agent in the solution the surface of the iron is rid of any film of oxide which might be present. The zinc is then deposited on a clean surface, ensuring absolute adhesion. The solution being rich in the required mineral, on account of its great solvent power, and as it cannot be decomposed under ordinary conditions, the rate of depositing may be high. It is possible to deposit 1 to 2 gm. of zinc per ampere-hour at a pressure of 2 volts, so that the efficiency is nearly 100 per cent. There being no heat required, it is possible to galvanize springs, &c., as the qualities of the iron are not impaired. Many interesting examples are on view, including valve bodies, nuts, screws, &c.

A number of interesting push-button service lifts for hotels, &c., by Brady & Co., Manchester, are to be seen. Instead of wire ropes steel tapes are employed, being greased as they pass through the gear bedplates. Since no balance weight is required, the lifts are worth consideration.

Legal.—The Osram Lamp Works, Ltd., *v.* The Z. Manufacturing Co., Ltd.—This patent action was mentioned to Mr. Justice Neville, in the Chancery Division, again on Wednesday, March 13th. Mr. Walter, who represented the plaintiffs, reminded his Lordship that permission had been given to apply to fix a day for hearing after March 12th, and Mr. T. Terrell, for the defendants, said they were most anxious to have the case tried during the present sittings, and if his Lordship could see his way to take it, they would be glad.

His Lordship asked as to the probable duration of the hearing, and Mr. Terrell said he did not think it ought to take long, as his Lordship was familiar with the patent.

Mr. Walter did not know that. The question in this action, he said, was not the same as that raised in the previous action before his Lordship.

His Lordship said he could not take the case before the 24th or 25th of the present month.

Mr. Terrell said the hearing would take four or five days, but Mr. Walter said his learned friend was sanguine. If he had said 8 or 10 he thought it would have been nearer the mark.

Mr. Justice Parker said if the parties did not mind the case being part heard, he would start it at these sittings, but he did not see how it could be finished before Easter.

Mr. Terrell said he would much rather it was not opened these sittings, if it could not be concluded.

Accordingly, the hearing stands adjourned until next sittings, when, in the ordinary course, it will come before Mr. Justice Warrington.

Decision in the Action against South Shields Corporation.—The hearing of the action in which John William Young and his wife claimed £80 damages from the South Shields Corporation in respect of shock sustained by Mrs. Young, through a flash of electricity caused by the fusing of an overhead tramway wire, at the foot of Fowler Street, on July 8th last, was resumed by Judge Bonsey, at a special sitting of South Shields County Court, on 11th inst. The circumstances were reported in our issue of February 16th.

On 11th inst. further evidence was called on behalf of the plaintiff.

Mr. Meynell submitted that there was no case against the defendants. There was no actual injury to the lady, and no evidence of anything to cause her reasonable fear for her safety. Secondly, he argued that there had been no negligence on the part of the defendants. The tram conductor, he pointed out, was on the roof of the car holding the trolley, and this was a precaution that was ordinarily taken in Shields. Trolley poles were liable to come off the overhead wires at junctions, and there was no means known to stop it.

Evidence was given by the motorman, the conductor of the car, Mr. L. Harvey, manager of the tramways, and others; and after a lengthy hearing, the Judge found that no negligence had been proved, and gave judgment for the Corporation.

Domestic Electricity.—In connection with the discussion on the extension of domestic uses of electricity, to be opened by the President of the Institution of Electrical Engineers on the the 21st inst., it is a matter of great importance to know why it is that electricity is not more largely used for domestic purposes. It is the object of the proposed discussion to find out and to bring about a clear understanding of all the causes and reasons which militate against its general adoption. Electrical men will then be in a position to discuss remedies and to take concerted action in the interests of electricity, and to the great benefit of the public. Some suggested causes are as follows: Price of energy; cost of electricity-using apparatus (radiators, cookers, iron-heaters, &c.); failure of electricity-using apparatus; want of knowledge of what electricity can do economically and well; the great facilities given by the suppliers of gas in the way of hiring apparatus on very low terms to induce consumption; cheap coal, cheap gas, cheap oil; natural objection to change; installation of houses; cost of service from street where more power required; the unsatisfactory tenure of electrical undertaking, which renders the raising of capital for giving a cheap supply so difficult; also want of good enough business methods in pushing sales; want of educational work; want of advertising.

Among the uses of electricity, other than lighting, may be cited cooking, water-heating, heating rooms, ironing, vacuum-cleaner driving, and small power uses for boot-cleaning; knife-cleaning; refrigerating; pumping, &c., also the operation of lifts.

We touch on this matter in our "Leaderette" columns this week.

Paisley Tramways Staff.—On Thursday last week, the Paisley District Tramways Co. held the last of their monthly dances for the winter. Several interesting presentations took place, the storekeeper being presented with a pipe, and Miss Alexander (Traffic Department) with a gold pendant and chain, for their services in connection with the dances during the winter.

On the previous day the final lecture for the season was delivered in connection with the Paisley District Tramwaymen's Recreation Club. Dr. Bruce, the leader of the Scottish National Antarctic Expedition, lectured on "A Trip to the Antarctic." There were present some 500 tramwaymen and friends.

Electricity Supply Rifle League.—At a meeting held at the Shoreditch Electricity Works on Tuesday last week, it was decided to form a Miniature Rifle League, as above, confined to members of the electricity supply stations in the London district. A circular letter had been sent to 50 stations, and replies had been received from 28. It was found that rifle clubs existed at the Central, Hackney, Ilford, Shoreditch, Stepney and Westminster works, whilst the question of forming clubs was under consideration at half-a-dozen other works. Representatives of Hackney, Ilford, Shoreditch and Westminster attended the above meeting, and decided to form a League at once, to be composed of teams from the six aforementioned clubs. Draft rules were drawn up to be circulated amongst the interested clubs, and a further meeting will be held next week at the Westminster Electricity Works to confirm them. Teams will consist of eight men, six to count, and it is hoped to shoot the majority of the matches shoulder to shoulder at 25 yards' range. Communications on the subject should be addressed to Mr. E. Mathews, hon. sec., 306, Mare Street, Hackney.

Fuel Economy and Bonuses.—A Central-Station Manager writes:—"May I suggest, through the medium of your useful and appreciated columns, that the present period of high fuel prices might prove a seasonable opportunity in which to ventilate by correspondence the question of saving fuel by bonuses on economies effected by improvements in firemen's work, &c.?"

Our "Correspondence" columns are open to any of our readers who wish to adopt this timely suggestion.

We understand that Mr. Crowther, as a result of experiments, has arranged with the scavenging department to deliver to the Worksop electricity works a sufficient quantity of dry refuse to keep the plant running for 16 hours per day out of the 24, reducing the weekly coal consumption by 50 per cent.

Indian Wiring Rules.—A revised series of wiring rules for electrical installations has lately been issued by the Bombay Fire Insurance Association.

Imports and Exports in February.—The trade returns for February (which this year had one working day more than the corresponding month of 1911) show an increase in value of imports by £3,648,463, an advance of £1,837,209 in exports, and an increase of £730,463 in re-exports.

Electrical goods and apparatus imported (other than machinery and telegraph and telephone wire) advanced by £29,251, making the figure for the month £134,995, the increase for the year so far being £43,442.

Machinery imported advanced by £58,376 to £509,569.

Electrical goods and apparatus exported increased by £27,261 to £252,989, the increase for the year so far being £99,356.

Machinery exported advanced by £118,293 to £2,346,656.

The Lighting of Railway Trains.—In his report to the Board of Trade on a collision which occurred on January 29th between two passenger trains near Saltley, on the Midland Railway, Major Pringle points out once more the liability of gas-lighted coaches to take fire. In the case under consideration, "the escaping gas ignited in some way, difficult to ascertain, and set fire to the floor of the vehicle. Fortunately a number of men from the adjoining goods yards were quickly on the spot, and the fire was extinguished with water from the exprsss engine before it obtained any strong hold upon the woodwork. Fortunately also, there was no wind to fan the flames, and there was comparatively little difficulty in getting access to the fire, as the coach kept an upright position on the rails. But the circumstances clearly point to the desirability of either abandoning the use of gas for lighting purposes or of making such structural alterations and additions which will lesson the liability of fire arising therefrom."

In our opinion, to strengthen the gas cylinders is mere temporising; the only sure remedy is to root them out, and adopt electric lighting.

The Bermondsey Council and the L.C.C.—Mr. T. C. Ekin, of the L.G.B., held an inquiry on Monday with reference to the refusal of the L.C.C. to sanction the borrowing of £18,563 for the extension of the Council's electricity undertaking. The Town Clerk (Mr. F. Ryall) represented the Bermondsey Borough Council; Mr. Bullivant the L.C.C.; and Mr. Sydney Morse the Bermondsey Municipal Association, who opposed the loan.

Mr. Bullivant at the outset explained that it was not the intention of the County Council to call any witnesses. They had refused to sanction the loan because the B.C. had declined to supply certain information. He held that after the present inquiry the L.G.B. must refer the matter to the County Council for their final decision.

The Inspector said he considered that the refusal of the L.C.C. to sanction the loan was an unqualified refusal.

The Town Clerk gave the usual statistical information, and said so far there had been spent on the work for which the loan had not been sanctioned, £7,000. Application for the loan was made to the L.C.C. on March 7th, 1911, and the tenders for the plant and buildings were accepted by the B.C. on June 10th. The refusal of the L.C.C. to sanction the loan was not notified until November 14th. The L.C.C. desired certain information, which was not supplied. The application for the loan was made on the same forms and in the identical terms as former loans, which had been invariably sanctioned. In 1907 the maximum demand for electricity was 730 KW., but in 1910 it had risen to 1,834 KW.; during the last 12 months the demand had fallen to 1,701 KW. The cost of generating in 1907 was 2·56d. per unit, but in 1910 it was 0·65d., which was the second lowest in London, Hackney being the lowest. In the first three years of the undertaking, 1901-3, there was a loss of £2,405, but the profits since then had amounted to £7,319. The amount of the loss had been made up from the rates, no portion of the profits being used for that purpose. Of the profits, £3,522 had been invested; £3,006 was reserve for capital works; £633 charged on revenue; and £180 unattached. They had no depreciation fund beyond the annual repayment of loans.

The Inspector remarked that he noticed the amount for public lighting in the accounts was very large—£4,019—or something like 16 per cent., and the Town Clerk replied that the charge for public lighting was 1·75d. per unit, about the average for London. In Stoke Newington it was 2·69d., and in Hackney 1·11d.

Mr. J. Buckman, the borough treasurer, was called, and said he considered that the L.C.C. were going outside their bounds, and asking for information they were not entitled to.

Mr. Bullivant asked that two letters offering a bulk supply from the County of London Electric Supply Co. should be read. Terms had been offered to the Borough Council, which had been refused, and they were entitled to know what those terms were.—The Inspector ruled that they were confidential documents, and he could not call upon the Council to disclose them; no doubt the Town Clerk would supply him with copies of the letters; the Town Clerk agreed.

Mr. Morse said the whole contention was that it would be much cheaper for the Council to obtain a bulk supply than to extend their plant. He then read the letters from the County of London Electric Supply Co. The first, dated December 18th, stated that the company was prepared to supply the Council with current for all-night public lighting in St. Olave's parish, Tooley Street, on the basis of ½d. per unit. The second letter stated that the company would supply and install a rotary converter having a capacity of 800 KW. in the council's generating station, the council undertaking the cleaning and running of same, and in view of guaranteeing a load factor of not less than 40 per cent. with a maximum demand of 800 KW. on the particular plant, the company would charge the low rate of ½d. per unit for L.T. direct current. The arrangement would be for a term of years, say, five to commence with, with a minimum annual consumption to be mutually agreed on. A third letter offered to supply at £3 10s. per KW., plus 0·33d. per unit, with a guarantee of a million units annually.

Mr. Buckman said the committee, he understood, considered these offers, and did not regard them as satisfactory.

Mr. Morse: We have examples that you are selling electricity at about half what it costs to generate.

The Inspector said the average cost of generating for 1910 was 1·28d., and the average price 1·35d.

Mr. Morse: There must be some mistake.

The Inspector: I must abide by these figures unless you can prove that they are wrong.

In reply to Mr. W. H. Ecroyd, L.C.C., Mr. Buckman said this was the first time the London County Council had asked for information about private companies, and the first time a loan had been refused because private information had not been given.

Mr. W. E. J. Heenan, the electrical engineer, gave details of the new plant, &c. These were as follows:—1,250 KW. steam dynamo, £6,052; foundations, £185; entrance to engine room, £80; condensing plant to deal with 40,000 lb. of steam, £5,030; foundations, £135; three water-tube boilers, each capable of evaporating 15,000 lb. of steam, £5,830; foundations, £310; boiler-feed pump, £350; foundations, £20; alterations to boiler house, £879. Contracts for these had been accepted, and some of the work had been done.

The Inspector: Suppose sanction is not given for the loan. What is going to occur?

The Town Clerk: If we do not get the sanction it simply means that we shall have to have an additional 5d. rate.

Mr. Heenan further said the company's offer was out of the question on the ground of cost.

Mr. Morse: If you once began to take a bulk supply from the company, there is no reason why you should not take your whole supply from them.

Mr. Owen Smith, a director of Haye's Wharf, Ltd., Bermondsey, was also called to give evidence against the application for the loan; he said he was a member of the Committee of the Municipal Association, which represented a large proportion of the ratepayers, and thought the matter had not received due consideration from the Council.

On Tuesday Mr. C. P. Sparks, consulting engineer to the County of London Electric Supply Co., at the second day's proceedings, gave evidence opposing the granting of the loan. He said a part of the present plant at the Bermondsey station was now, no doubt, obsolete, although only a part of the loan sanctioned for its purchase was paid off. If there was a demand to any great extent for electricity in Bermondsey in the near future the Council's present site would have to be abandoned, and he was sure the present station, along with the plant, would be obsolete, and of no use in 20 years' time. Bermondsey was an important industrial area in which power was required.

The Inspector: Practically 75 per cent. of the electricity supplied by the Council at the present time is for power.

Witness said in the future it would be even greater. He thought that the proposed 1,250-KW. dynamo might last for 20 years, if the work did not outgrow the plant; but in Bermondsey they had a developing business, and he thought 10 years would be an extreme period for the life of this plant. And if a plant would only last 10 years, the loans should be paid in those years. They would have to face the fact of an increased price of coal, but the County of London Electric Supply Co. in their offer for five years, would take the risk of any increase in the price of coal. The possibility was that at the end of five years the Council would be able to enter into a new contract on more favourable terms. The Council would get a very much lower price if the public lighting was open to public tender. In the parish of St. Olaves an offer had been made to the Council to supply current for street lighting at ½d. per unit, but that had not been accepted. Supposing the price for public lighting had been reduced to ¾d. per unit, it would have entirely wiped out any profit balance the Council showed. He suggested that ¾d. was the highest figure that should be charged for public lighting, for if tenders were accepted in opposition to the Council, it would be reduced to ½d. per unit. The whole of the Council's balance and reserve fund had grown through the overcharging for public lighting.

Mr. H. R. J. Burstall, consulting engineer to the London Electric Supply Corporation, corroborated.

Councillor Eddis, secretary of the Bermondsey Municipal Association, handed in a list showing that the subscribers to his Association numbered 207.

The Town Clerk: Only 207, out of a total population of 125,000.

Counsel having addressed the Inspector, the inquiry closed in the usual way.

Copper.—The returns for February, now to hand, embodied in Messrs. Merton's statistical circular, show brisker demand and consequent rise in prices. It will be interesting to compare these with returns for the present month. The visible supplies, 51,507 tons, are 4,063 tons less than those for the preceding month-end. Supplies from North America to this country are nearly one-third above the average, from Spain just above, from Chili well over, and from Australia rather below. Deliveries, at 52,743 tons, are the highest for some years, the average for this year not exceeding 42,300 tons. The stock of fine copper in Rotterdam has decreased 1,300 tons, and that in Hamburg 300 tons. The world's visible supply for the end of January, excluding Holland and Germany, was 85,159 tons. The American supplies on the same date amounted to 29,589 tons, a reduction of 10,346 tons on the returns for December 31st.

Appointments Vacant.—Wireless telegraph operator, for the Government station, Fiji Islands (£200); engineering and mechanical draughtsman, for the Corporation Electricity Department, Stoke-on-Trent (£104); mains superintendent for the Borough Electricity Department, Plymouth (£3); mains assistant and meter tester for the Borough Electricity Department, Bridlington (£90). See our advertisement pages to-day.

International Smoke Abatement Exhibition.—The following is the programme of conferences and lectures to be held during the run of the Exhibition at the Royal Agricultural Hall:—

Section A.—March 26th, 1912, at 11 a.m. and 2.30 p.m Chairman, Sir William B. Richmond, K.C.B., R.A. (President, Coal Smoke Abatement Society.)

Smoke Pollution.—(1) Its economical and artistic effects. (2) Effects on animal and plant life.

Section B.—March 27th, 1912, at 11 a.m. and 2.30 p.m. Chairman, Sir William Ramsay, K.C.B., F.R.S.

Smoke Abatement.—(1) Work done and to be done in organising preventive action.

(2) The Physics of Smoke Abatement. Apparatus and practical expedients for the abolition of smoke, both industrial and domestic.

Section C.—March 28th, 1912, at 11 a.m. and 5 p.m. Chairman, Lord Justice Fletcher Moulton.

Law and Legislation.—(1) The existing law and its administration, both at home and abroad. Comparative legislation. (2) Proposed new legislation.

Coal Strike.—As we go to press the prospects of an early settlement are not very encouraging. All that can be said is that there is a movement in the right direction. Meanwhile the industrial position throughout the whole country is becoming desperately serious, and whenever peace may come it is certain that we shall feel the effects of the calamity long after normal working of the collieries is resumed. The users of power continue to feel the benefit of the electric drive and their consequently decreased immediate dependence upon coal. Electricity suppliers in most places will be able to meet the normal demand for some weeks yet, but in places circulars have been issued suggesting the exercise of economy. In the House of Commons notices have been issued by the Serjeant-at-Arms suggesting the exercise of special economy in the use of electric current and gas in all rooms. Factory owners in various places have been urged to put their men on part time spread over a longer period rather than to work full time and then abruptly close.

Institution and Lecture Notes.—Mr. W. H. Telfer, Glasgow, general manager of the Wilson's & Clyde Coal Co., recently delivered an address on "Electricity in Mining Operations" to a meeting of colliery managers and mining electrical engineers at Hamilton. Mr. Telfer said that in Lanarkshire, more extensively, and, he believed, more successfully than in any other coalfield, they had been able to work very thin seams of coal, thanks to the adoption of electric power for coal cutting and coal-face conveyors. One of the greatest dangers attending the use of electricity was the risk of fire, but even that risk could be pretty well eliminated. Where they had a coal seam which gave off gas very freely, or was subject to outbursts of gas, or produced a lot of fine explosive dust in working, electricity should not be used at the face at all. If power was required at the face in such a seam, compressed air could be used. For a very gassy mine where a lot of power was required all over underground, he believed strongly in having both compressed air and electricity. In the majority of pits worked with safety lamps, the gas given off was easily diluted and carried away. In such cases, and provided there was not explosive dust in quantity, he considered an electric motor as safe as a safety lamp.

Printing Crafts Guild.—A paper was recently read by Mr. R. F. Singleton before this society at the Manchester School of Technology, on the subject of "Electrical Driving: Its Application to Wharfedale and Platen Printing Machines." The author advocated individual driving of such machines and placed the saving of power by dispensing with belting and shafting at from 25 to 70 per cent. A comparison of power costs by Manchester gas and electricity was included, favouring the latter. In discussing the paper, Mr. Fishenden expressed a preference for open-type motors, boxed in, as enclosed-type machines, besides being less efficient, were liable to accumulate dust and oil, and in case of internal smouldering, were difficult to get at. A Mr. McVay (according to the *British and Colonial Printer and Stationer*), argued that the gas engine had advantages in its overload capacity, and that a 5-H.P. motor would be required where a 2-H.P. gas engine would be sufficient! Possibly the reporter has transposed his remarks.

Institution of Electrical Engineers (London).—A lecture was to be given last night by Messrs. T. Stevens and J. B. Cox, entitled "Notes on an Avalanche which occurred on the Wellington (U.S.A.) Tunnel Electric Railway," with lantern slides.

Institution of Electrical Engineers (Dublin Section).—A meeting of the Section was to be held yesterday to hear a paper on "Peat as Gas-engine Fuel: New Developments," by Mr. Thomas Tomlinson.

Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch recently, a paper was read by Mr. J. R. Laird, Niddrie, on "Electricity Applied to the Scottish Shale Oil Industry." Mr. Laird explained that until 1901, the oil works in Scotland had not centralised their power. In 1901, however, the pioneer scheme for electrifying oil works was carried out by the Oakbank Oil Co., Ltd. Since then almost all the Scottish oil companies had centralised their power and adopted electrical distribution. This had revolutionised the industry, and enabled the local firms to compete with oil companies abroad, who had not to do any mining or retorting, but simply to bore for the oil.

A lecture was given before the Leeds University Engineering Society on the 4th inst., by Mr. W. E. French, on the subject of "Safety Devices applied to Electrical Apparatus used in Mines."

Mr. T. M'Call White last week submitted a paper on "Electric Motors and their Application to Power Driving" at a meeting of the Manchester Association of Students attached to the Institution of Civil Engineers.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Hammersmith B.C. has before it a scheme, prepared as the result of an investigation of municipal salaries in London, under which it is proposed to raise the maximum salary of the borough electrical engineer from £600 to £750. It appears that the present salary of Mr. G. G. Bell, who has held the office for between 15 and 16 years, is £700. The maximum for the chief assistant engineer is to be advanced from £300 to £400 by increments of £20 (Mr. F. Hill's present salary, after nearly 15 years' service, is £350); the maximum of the station superintendent is to be raised from £300 to £350 by increments of £10 (Mr. R. H. Paterson's present salary is £300).

At a meeting of the Dundee Town Council, Mr. N. Macdonald objected to the salary of Mr. H. Richardson, the Corporation electrical engineer, being raised by £50, and moved disapproval of the recommendation. Mr. J. M. Nairn, convener of the Electricity Committee, moved that the increase be granted, remarking that if any man deserved an increase it was Mr. Richardson, who had done splendid work for the city. On a vote, the increase was granted by 20 votes to 8.

The Electric Light Committee for the Bath T.C. has again recommended the Council to increase the salary of Mr. C. A. Nethercot from £160 to a maximum of £175 per annum.

The Newport (Mon.) tramway and lighting staff has presented a case of silver spoons and tongs to Mr. Collings Bishop, late Borough Electrical Engineer and Tramways Manager, and a gold mounted umbrella to Mrs. Bishop. The Electricity Committee has accepted the resignation of Mr. L. du Verge, Deputy Borough Electrical Engineer and Tramways Manager.

The Darlington T.C. has appointed Mr. K. F. Bishop as Shift Engineer at the Electricity Works at £130 per annum, rising by two annual increments to a maximum of £156.

In our description last October of the undertaking of the Tientsin Gas and Electric Light Co., Ltd., at Tientsin, we mentioned that the station was run by a European staff, consisting of Mr. G. Paton and one other "foreign assistant." The latter is now in charge of the station. By name he is Mr. C. D. Stewart, A.M.I.Mech.E., and lest anyone should be misled by the description of "foreign assistant," we may remark on his own authority that he is "a loyal and true Britisher," and is "not a foreigner to the business nor to anything else, save the country in which he is living." Mr. Paton, as our readers will remember, left the company a short time ago to take up other work in China.

Tramway Officials.—On March 7th the Aberdeen Corporation tramway officials presented Mr. W. T. Young, the traffic superintendent, with a case of cutlery on the occasion of his departure for Oldham, where he is taking up a similar position. Mr. R. S. Pilcher, general manager, made the presentation.

Mr. Thomas Holden, leading linesman in the Liverpool tramways overhead lines department, has been appointed chief linesman, in place of Mr. J. M. Lamb, resigned.

Mr. W. J. Gale, assistant engineer on the Milnrow tramways of the Rochdale T.C., has resigned, and left for Calgary, North-West Canada.

General.—Mr. G. E. Wright, electrical engineer to the North-Western Railway, Lahore, India, will not arrive in this country on furlough until the beginning of April. It is his intention during his stay here to make a fairly complete tour of inspection of the leading electrical manufacturing undertakings, and to prepare a report thereon with special reference to Indian requirements. He also hopes to be afforded the opportunity of visiting central stations in which there have been noteworthy developments since he was here some six years ago.

Mr. D. Hervey Slack, A.C.G.I., of the firm of Messrs. Bauer and Imrie, chartered patent agents, 72, Cannon Street, E.C., has recently been elected a Fellow of the Chartered Institute of Patent Agents, and we are informed that the style of the firm will in future be Bauer, Imrie & Slack. Mr. Slack has had considerable practical experience, especially in electrical engineering, which will be of great advantage to him in his work.

Mr. Geo. Mason, electrician to the Sherburn Hill Colliery (Co. Durham), has taken up a more important position with the Broomhill Colliery Co.

Mr. J. H. Thomas, late of the A.E.G. Electric Co., has left Berlin for the Far East, to take up a position there.

Mr. John Pendreich has resigned his position as representative of the General Electric Co., Ltd., Glasgow, in order to join the firm of Millar & Stewart, wholesale agents for electrical supplies, Hanover Street, Edinburgh.

The *Australian Mining Standard* states that Mr. A. Dircks, electrical engineer, of Victoria, is to carry on the duties of chief Commonwealth electrician during the absence, in America and Europe, of Mr. Hesketh.

On the occasion of the laying of the foundation stone of the new County Hall on 9th inst., his Majesty the King conferred the honour of knighthood upon Mr. Maurice Fitzmaurice, the chief engineer to the L.C.C., and upon Mr. Edward White, the chairman of that body.

The Burnley Guardians have created a new post at the workhouse, this being an engineer-in-chief, at £208 per year. Mr. W. E. Atkinson, who has been appointed, will be responsible for the plant for heating, hot water supply, laundry and kitchen, electrical generating plant and battery, and all pumping plant, &c.

Mr. J. S. B. Plummer, who for many years acted as secretary to the Armorduct Manufacturing Co., Ltd., is shortly starting for a trip round the world on behalf of the firm.

Obituary.—J. D. Gibbs.—We regret to learn that Mr. John Dixon Gibbs died on the 6th inst., at the age of 78. Mr. Gibbs came prominently before the electrical world in 1883 in connection with the Gaulard & Gibbs secondary generators, which were patented by Mr. Lucien Gaulard and himself. These secondary generators were the forerunner of the modern transformer, and at their introduction in the year 1883 they were the source of very considerable discussion and opposition. They were exhibited at Turin, where the first International Prize and Gold Medal was awarded to Messrs Gaulard & Gibbs for their work in this connection. At the Exhibition held at the Royal Aquarium in 1883 these secondary generators were shown and excited a good deal of comment. Between the years 1883 and 1886 Gaulard & Gibbs installed their system on the Metropolitan Railway having their generating station at Edgware Road and lighting five of the Metropolitan stations, the secondary generators being arranged in series on a primary wire about 15 miles in length. At the Inventions Exhibition of 1885, several of the courts were lighted by Messrs. Gaulard and Gibbs, who were awarded a gold medal for the successful working out of a system of distribution of electricity by induced currents. The Grosvenor Gallery installation was erected in 1885 for lighting portions of Regent Street, Bond Street and Oxford Street by means of the secondary generators. In the year 1885 the Gaulard & Gibbs system was taken up by Mr. George Westinghouse for the United States, who had a complete installation sent out to him at Pittsburg. The secondary generators of Messrs. Gaulard & Gibbs were from a modern point of view extremely crude, but it must be remembered that at the date at which they were brought out, alternating-current distribution by means of the transformer system was unknown, and they were the first to attempt the distribution of electricity by such means. It is strange to realise the amount of opposition that was raised to this system, and great credit is due to Messrs. Gaulard & Gibbs for their persistence in spite of all opposition, for the faith in their system which they championed. They clearly realised the enormous possibilities that would arise from the use of transformers, and they persisted in spite of all obstacles, in developing the apparatus in which they had such faith. They risked their all in the work, and the developments of the past 25 years have proved that their faith in the possibilities of the transformer system were justified. Lucien Gaulard died some years ago; his native place has erected a statue in recognition of his work.

CITY NOTES.

W. T. Henley's Telegraph Works Co., Ltd.

The meeting of this company was held on Monday at 13 and 14, Blomfield Street, E.C., Mr. George Sutton, M.I.E.E., the managing director, presiding.

The Chairman explained that he was occupying that position in the absence of Mr. Sydney Gedge, the chairman, owing to a domestic bereavement. Proceeding to propose the adoption of the report (see Electrical Review, page 397), Mr. Sutton said he was sure it was with much pleasure that the shareholders had received the report. On the debit side of the balance-sheet it would be noticed that they had increased the reserve fund by £10,000 out of the profits of the year. On the credit side £13,000 had been added to the property during the year, which was rather smaller than the previous year, when they added nearly £25,000. The reason for it being only £13,000 this year was because they had had so much other work to do that they had not been able to give the time and attention they otherwise would have done to rebuilding and putting down new machinery. They had written off £2,403 for depreciation on their investments. The stock had increased during the year, but that was due to the larger turnover. It had gone up by some £17,000 or £20,000. He was not dissatisfied with the turnover in value, it was as high as in the best year they had had—that was the preceding year of 1910. In quantity it was larger, but it had varied from the previous year by large contracts showing a falling off, whereas what he might call the bread-and-butter business, and, therefore, the business which gave a larger percentage of profit than the contract business, had increased. The home trade had increased, and the Colonial trade had increased, but the foreign trade showed a falling off. The competition for business, both at home and abroad was very keen, and perhaps the foreign buyer was not so wel acquainted with the reliability of certain manufacturers as were British or Colonial buyers, and was more likely to buy inferior goods because of the lower prices. They had in Great Britain a well-known standard for insulated wires and cables; it was made by an association of the leading cable-makers in this country, and was a synonym for the best work; but there were British houses not forming a part of the association which apparently did not think it imcompatible with fair trading to advertise, list, and sell cables—sometimes cables made in foreign factories—as being made to the standard of that association. They tried to reap where they had not sown. The home buyer and the home consulting engineer was usually well able to discriminate, but the foreign firm might not be. They would observe that the net profit was larger than in the previous year because of a less amount being written off for depreciation—£11,800, against £17,200. That was due to the fact that not so much machinery had been scrapped, and the value at which that machinery, plant and building stood on the books was added to the year's depreciation. Then the increase of the available balance was due also to the fact that £2,400 was reserved against gilt-edged securities, as compared with £6,400 in the previous year. The reserve for bad debts was the largest they had had for some years, due to the fact that they had not received payment for any of the cable they supplied to the Thames Ironworks Co. for use on H.M.S. *Thunderer*; the amount was increased by upwards of £2,000 on that account. But nevertheless the important outstanding fact was that they had presented to them the best balance-sheet and profit and loss account which the company had so far produced. The only unpleasant and disquieting feature of the year was the strike at the Gravesend works, and even that had its compensation, for it demonstrated the loyalty and regard for their interests of the larger works at North Woolwich, at which not one man left his work, notwithstanding the pressure brought to bear on the men by the union and the men on strike at Gravesend. It was often said that, unlike the private employer, the limited liability company was not in touch with the people it employed. That might be sometimes true, but it was not true in respect to their factories. Of course he did not know all their workpeople, although he was personally acquainted with very many of them, but they all knew him, and they all knew, and they availed themselves of the knowledge, that they could communicate with him if they wished to do so. When the strike at Gravesend occurred he was in the north of Europe, and on the receipt of a telegram informing him of the strike he wired back a notice to be posted outside the works that he was coming home at once and would see the disaffected men at the works at a certain time and discuss their grievances with them. He was there at the appointed time and not a man came to see him; the notice on the gate had been torn down. But he might weary them if he were to go into the whole history of that stormy six weeks—how every obstacle was put in the way of the company carrying on its business, how stones, bricks and mud were thrown, how loyal men were assaulted on their way to and from their work, so that they had to feed and lodge them on the premises; how their very houses were besieged by men, so that in some cases the company had to send their wives and children away, and how, on one occasion, some 2,000 men were round the works and were prevented from breaking in the gates, by the exit from the gates of a body of police whom he had summoned because of the threatening state of affairs, and how, at last, the men came back to their work without any request for new terms or conditions. It was an iniquitous strike. They did not discriminate between Union or non-Union labour. They paid better wages than other industries in the district. Their workshops were the best that money and skill could obtain. But they found that there were men in the works who were acting for the Union in getting their hands to become members and spreading discontent amongst them. They wanted to be just, they even wished to be generous with their men, but they refused to be dictated to by a Trade Union, and the financial state of the company was such that they were not to be coerced into doing that which might be unfair to their interests, even if they had to struggle with a Trade Union for ten times the period of last year's strike. He took the opportunity of expressing on behalf of the shareholders his appreciation of the services of those of their people who, often under great trial, were loyal to them and did any kind of work which was required of them under the exigencies of the situation, and to their people at North Woolwich for their loyalty and many expressions of sympathy which they received from them during the course of the strike.

The Earl of Galloway seconded the report, and it was adopted.

Vera Cruz Electric Light, Power and Traction, Ltd.—The directors have declared a dividend, subject to audit, of 2 per cent. in respect of the year 1911.

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from March 18th to 31st for the preparation of warrants for interest at the rate of 4½ per cent. per annum, payable April 1st, for the half-year ended that date.

Rees Roturbo Manufacturing Co., Ltd.—The directors' report for the fourteen months to December 31st, shows that after deducting £3,356 brought forward, there is a debit balance of profit and loss account of £1,544.

British Insulated and Helsby Cables, Ltd.—The directors have declared a dividend of 6s. per share, making 10 per cent. for the year, £51,000 being placed to reserve and depreciation, and £65,500 is carried forward.

Brompton and Kensington Electricity Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the revenue account shows a credit balance of £30,692, which, with the balance of £7,443 brought forward, and £939 balance of interest received and accrued, makes a total of £39,075. After deducting £1,663 for interim dividend on the 7 per cent. cumulative preference shares, and £6,861 interim dividend at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that the sum remaining, viz., £30,550, be dealt with as follows: To credit of depreciation account (maintaining this fund at £80,000), £6,063; dividend on the preference shares for half-year ended December 31st, £1,612; dividend on the ordinary shares for half-year ended December 31st at the rate of 11 per cent. per annum, making 10 per cent. for the year (free of income-tax), £8,461; to credit of reserve fund account (raising this fund to £30,000), £6,000; directors' additional remuneration, £557, leaving to be carried forward £7,858.

The following table shows the progress of the business:—

Year.	35-watt lamps connected.	Increase in lamps.	No. of customers.	Gross receipts.	Expenditure.	Net receipts.	Aver. price per unit.	Div. on ord. shares.
1908	224,826	10,910	4,598	£53,113	£25,318	£27,795	4·17d.	10%
1909	235,802	10,976	4,883	£50,791	£23,710	£27,081	4·18d.	10%
1910	246,974	11,172	5,163	£50,597	£23,917	£26,680	4·26d.	10%
1911	259,554	12,580	5,453	£54,780	£24,088	£30,692	4·29d.	10%

In view of prospective development, the directors propose to carry on such portion of the company's business as may not come within the scope of its provisional order by means of a subsidiary company. To carry out this departure in the most effective way, some alteration in the company's articles is necessary, and acting under legal advice the directors are availing themselves of this opportunity to bring the company's articles up to date.

The meeting was called for March 14th, and resolutions were then submitted, altering the articles and deciding as follows:—

That the agreement entered into between this company and the Brompton and Kensington Accessories Co., Ltd., dated March 6th, 1912, and subscribed for identification by the chairman of this meeting, whereby this company has sold to the Brompton and Kensington Accessories Co., Ltd., for the sum of £2,611 2s. 6d. payable in cash, all its interest in the leasehold premises, 254, Earl's Court Road, Kensington, S.W., and the goodwill, stock-in-trade, and effects of its business of supplying electrical apparatus, utensils and accessories as mentioned in the said agreement, be and the same is hereby confirmed.

Notting Hill Electric Lighting Co., Ltd.

THE annual meeting was held on March 5th, at Winchester House, E.C., Sir W. Crookes, O.M., F.R.S., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 353), remarked that this was their twenty-fifth annual meeting, and they looked back with satisfaction on the progress made during a quarter of a century. In the accounts the share capital was in the altered form, in accordance with the scheme of rearrangement of capital which was agreed upon last year. The founders' shares had disappeared, and were replaced by the new 1s. ordinary shares. If they required new capital, it would be seen that they still had £56,000 6 per cent. preference shares unissued. The capital expenditure for the year was £4,074 on machinery, mains and meters. The machinery purchased consisted of a new motor generator set to deal with the increased demand. The total capital expenditure now stood at £247,406. They had received additional capital during the year amounting to £1,352, being the profits of the issue on 27,050 new 1s. ordinary shares. They had spent more capital than they had received to the extent of £38,054, and that had been provided by using the reserve fund in the business instead of issuing further capital. The profit had increased from £22,003 to £23,557. The actual increase in revenue was £2,000, and it was a most satisfactory feature that the whole of this would have been extra profit but for one item on the expenditure side, £461 charged against the account for the rearrangement of capital. For that excellent result thanks were due to the whole of the staff. The balance available for dividend was £14,486, compared with £12,905. £3,000 had been allocated to the depreciation fund, which was considered sufficient, especially as the capital expenditure had been very small for many years past. The depreciation, renewal and reserve fund account showed net figures of £37,493 to meet depreciation of the undertaking, and the board believed that that total was ample, considering the good position in which the plant was maintained at the expense of revenue. The amount of electricity sold during the year was 2,336,849 units. The houses connected were 3,513 and the lamps connected 199,156. The amount of profit available for division amongst the ordinary shareholders, after allowing for debenture interest, was £14,486. Of this, the preference shares had taken £8,136, which left £6,350 for division between the holders of the new 1s. ordinary shares. The board had carefully considered the question, and had decided to recommend the payment of a dividend on those shares of 4s. 6d. per share, carrying forward the balance of £618. They considered that a wise precaution in view of the unsettled state of the labour world. Had the expenses of the rearrangement of the capital not been charged to revenue and its balance utilised, the dividend would have been over 5s. He was glad to be able to tell the shareholders that the men had shown their loyalty to the company, and in order to recognise this the board were considering a scheme of co-partnership by which the men should receive, by way of bonus, a sum proportionate to the profits realised. He felt sure that that proposal would meet with the approval of the shareholders. The dividends which the board recommended would have amounted, had the shares not been divided, to 8½ per cent. for the old preference and ordinary shares and £6 per share for the founders—more than they had ever received before. The great advantage in the re-arrangement was that the holders could now estimate the real value of their security. The non-cumulative preference shares paid 6 per cent., and could not be repaid at par until 1931, and allowing that they were so repaid, on an actuarial calculation they yielded 4½ per cent. if purchased at £12. The security was ample, as, after paying £6,442, the dividend on the shares, there was £6,350 left. In other words, the margin of security was 100 per cent. With regard to the future, the outlook was promising, and the demand for current showed no signs at present of any diminution, so that provided the trouble in the coal trade could be settled without a serious rise in prices—they had a reserve of two months' supply—he saw no reason to doubt that the company would continue its prosperity. The London County Council had recently appointed a special committee to consider the whole question of the electric supply to London, and the shareholders might be assured that, whatever arrangements were come to, they would safeguard the interests of the company as far as it was possible.

MR. A. E. FRANKLIN, J.P., seconded the motion.

MR. DAWES, after congratulating the board upon the present position and prospects of the company, said he was very pleased to hear from the chairman that they contemplated a scheme of co-partnership with the workpeople. Even if they looked at it from a selfish point of view, wherever similar schemes had been tried it had been found that the proprietors had got back all and possibly more than they had given to the men, because, naturally, men felt a greater interest in their work when they were participating in the profits.

MR. CORNER also congratulated the board upon their determination to adopt a co-partnership scheme.

The CHAIRMAN, in reply, said that the scheme was only in its preliminary stage. They were going to meet a deputation of some of the men and discuss the question with them before anything definite was done.

The report was then adopted.

Slough and Datchet Electric Supply Co., Ltd.

DURING 1911 capital expenditure was incurred to the amount of £5,479, bringing the total up to £54,634. The following table from the report shows the progress of the company, the equivalent of 6,139 additional lamps of 8 C.P. having been connected last year:—

Year.	Lamps and motors connected.	Units sold.	Profit.
1909	16,380	335,983	£3,288
1910	17,976	332,295	£3,165
1911	24,115	426,136	£3,421

The total net profit available for distribution is £4,073, £1,000 is to be set aside to the depreciation fund, bringing it up to £4,750, and the directors recommend that out of the remaining net profit a dividend of 5 per cent. be declared, less income-tax, and that the balance of £390 be carried forward.

The mains, works, plant and machinery have been maintained in an efficient condition out of revenue. A new engine and dynamo of 200-H.P. were installed during the latter part of the year, which are showing considerable saving in the cost of producing the current, and another set of similar capacity is in course of erection. This new plant was found necessary to meet the growing demand for electricity in the district, and there is every indication that the economies effected by the new plant will result in a considerable reduction in the working costs and a corresponding increase in net profits.

South London Electric Supply Corporation, Ltd.

THE directors' report for 1911 shows that the gross receipts were £44,515, and the expenditure £19,272, leaving a profit balance of £25,243, plus £1,002 brought forward, making £26,245 available. After providing for depreciation on plant and machinery (£6,000), debenture and other interest accrued, &c., £12,337, there remains to be carried to the general balance sheet £13,908. Out of this the board recommend the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, amounting to £13,000, carrying forward £908. At the end of 1911 there were connected to the company's mains the equivalent of 250,721 (35-watt) lamps. The plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The ratio of total costs to revenue has been maintained at 43 per cent. At the last quinquennial revision the rateable value of the company's property was, after prolonged negotiations, raised so as to involve an increase of £600 per annum in the rates.

Units generated	5,662,845
Sold to consumers and public lamps	4,479,487
Used on works	371,010
Total	4,850,497
Used in distribution	812,348
Total KW. connected	8,770

The meeting is called for March 19th.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended January 26th, 1912, was 592,344, compared with 537,547 units in the corresponding four weeks of 1911.

Scarborough Electric Light Supply Co., Ltd.

At the annual meeting held at Scarborough on March 4th, the Chairman (Mr. Alderson Smith, J.P., D.L.) said that the balance-sheet was a little disappointing, but they knew the cause.

Though they had morecustomers and gave better satisfaction, the use of the new metallic-filament lamps had diminished the amount they actually received. There was £155 less for electrical energy than the preceding year, and for the sale of lamps £101 less. If they could but get more people to become customers their prosperity would increase; but so few of the houses in Scarborough belonged to the people who lived in them that there was difficulty about putting in the electric light.

Mr. A. A. Campbell Swinton (managing director) seconding the report, said the question of metallic-filament lamps was one that had been interesting him for years. In addition to being concerned with that company, he was also concerned with the management of electricity supply in, he thought, 49 different towns in Great Britain, and had special means of seeing what was taking place. When people changed, the first effect was to largely reduce the amount of their bills. The second effect was that they attracted more consumers as electric light became cheaper and competed more readily with gas. Throughout the country the effect had been the same. There was a fall in the consumption of practically every electric supply company, and then a gradual recovery due to more people coming on. In some places this had been much more rapid than in others. In Scarborough, owing to local circumstances to which the Chairman had alluded, it had been almost slower than anywhere else. They could safely say now that they has touched bottom, and were beginning to improve by taking on more customers. His own view was that the company's prospects were now likely to improve as time went on. With regard to depreciation, he had had two letters from shareholders. One accurately pointed out that railway companies put nothing aside for depreciation, and why should the Electric Supply Co. do so, as if they put the £1,000 they had put to depreciation this year to paying more dividend, they could pay 4 per cent. instead of 3. The other shareholder took the opposite view, and would like to see the whole 3 per cent. as well put to depreciation. Well, this year, in addition to the £1,000 to depreciation, they had spent £1,112 on upkeep. In 1910 they similarly spent £1,068, and he thought they also put £1,000 to depreciation. They kept everything up to date out of revenue, and what they put to depreciation must be looked upon as a provision for renewing plant when it became worn out. The first thing they would want to renew would be the boilers. There seemed an idea that the price of electricity in Scarborough was high. Of course they could not compare it with Leeds, which was supplying about 15 times as much electricity. Take Bridlington. In Scarborough they charged less, although Bridlington had a supply of public lamps for which they got over 3d. per unit, which was a large price for public lighting. The supply in Scarborough was cheaper on the average to the private consumers than at Bridlington. In Whitby it was slightly less, but again, they had a large amount of public lighting, for which they got good prices. York was hardly comparable, but there they got over 2d. a unit for the tramway route. In Scarborough they got only 1¼d. They had not been able to arrange it there that the people who travelled on the tramways should pay part of the electric lighting bill. They had no public lighting in Scarborough, and they had to supply the tramways, which paid badly.

The Chairman said that they had coal to last for six weeks' consumption at full use.

Mr. Hutton (a shareholder) argued that the local conditions must determine their price and policy. He complained that some of the consumers had never been met since the supply started, and they should consider the question of bringing down the cost to those who paid the maximum rate. There was a general feeling that if the price could be reduced even a little it would alter the attitude of the public towards the supply.

Mr. Campbell-Swinton replied that to reduce the price might increase the number of consumers, but it would mean more capital expenditure, and he did not know whether they would get it with a large expenditure. The only policy for the company was a quiet one.

A dividend of 3 per cent. was declared.

Telegraph Construction and Maintenance Co., Ltd.

The meeting of this company was held on February 29th, at 38, Old Broad Street, E.C., the Earl of Selborne, K.G., presiding.

The Chairman first went briefly through the accounts. The net profit for the year amounted to £87,515, plus £107,577 brought forward, making £195,093, from which was deducted the interim dividend of 5 per cent. paid in July last. The directors now proposed to distribute a further dividend of 10 per cent., together with a bonus of six shillings (6s.) per share, and to add £10,000 to the reserve fund, which left £106,658 to be carried forward. He would draw a comparison between the balance-sheet of this year and that presented to them a year ago. Taking, first of all, the debit side, they would see that the capital and debentures stood at exactly the same figure as they did last year. When they came to the item of debts owing by the company, and reserves for insurance and contingencies, the figure was very considerably larger this year than last, and a little explanation of that matter was required. The increase was mainly made up in this way—rather a peculiar circumstance—they had received payment for a considerable amount of cable not yet delivered, and, therefore, they had put that payment to a suspense account, which swelled the tem under the head of debts owing by the company and reserves for insurance and contingencies. The reserved fund, they would notice, stood at £75,000 instead of £50,056. That was owing to the increase they authorised last year, and he was going to ask their authority for a further increase of £10,000 to the fund. The profit and loss, of course, showed a falling off. That was due to the fact that this year, although they had been able to do steady work, they had not had the special feature of the previous year. Turning to the credit side of the account, he drew their attention first of all to the item property, consisting of freehold and leasehold premises, machinery, plant, stocks of stores, materials, &c. Last year that item stood at the unusually small figure of £205,000 odd. This year it stood at £569,000 odd. The very large figure shown this year was more in accordance with experience. The reason was that their stocks of materials in hand were much larger this year than they were at that particular time last year—a mere accident in the process of manufacture—also the amount of cable under construction, as also the amount of cable completed but not yet delivered. Amounts owing to the company, and cash at bankers, and in hand, were both less than last year, which, of course, was the natural result of the fact that the first item was increased. Sundry securities showed a diminution of, roughly, £20,000. They were careful not to over-estimate the value of the securities or the property, although they did not carry depreciation to an extravagant extent. As regarded leasehold property, machinery, and plant, their practice was to be conservative and cautious in their estimate, to remember that in the nature of affairs such property was transitory and apt to deteriorate in value, and if they erred at all in respect of the valuation they put on that part of their property, they valued them too low rather than too high. He now turned from the accounts to the actual resolution that he was going to move. The past year lacked the special features of the year before, although it was not a year that could by any means be considered unsatisfactory in its results. But they felt that that was a moment in which it was their absolute duty to be cautious and conservative in the policy they recommended. He was happy to say that the relations between their employés and the company were excellent, but they could not conceal from themselves that there is an unrest in the industrial world over which they had no control, but which might fundamentally affect their business during the coming year. Therefore, with a year before them which they could not characterise but as a year of anxiety, they felt that a cautious policy was the right one.

Sir James Pender seconded the adoption of the report and the dividend declaration, and the resolution was carried unanimously.

The Chairman then submitted the following resolution to the meeting: "That the holding of half-yearly general meetings be discontinued."

Mr. Colin F. Campbell seconded, and after some remarks from a shareholder, this resolution was also carried unanimously.

Hove Electric Lighting Co., Ltd.

The annual meeting of this company was held on March 6th, at Salisbury House, E.C., Mr. Carleton F. Tufnell presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 354), said that the capital expenditure during the year had amounted to £5,292, of which £880 had been expended on mains, £379 on meters, and £4,025 on additional machinery and tools. The increase in the last item was accounted for principally by the introduction of a new steam turbine set. There had again been a decrease in the number of units sold, no doubt chiefly due to the metal-filament lamp. Those lamps were now being made for low candle-powers, and they were largely used in passages and servants' quarters where the lights were generally in use for long hours. The consequent cheapening of the electric current was bringing them more consumers. During 1911 they connected up 179 houses, the largest number in any one year since their commencement. The number of lamps connected (equivalent in 8-c.p. lamps) had been 8,983, compared with 6,271 in 1910. Then again, the period covered by the report had embraced probably the finest and lightest summer on record, whilst the winter months had likewise been peculiarly free from fogs and dark days, with the very natural result that their revenue had suffered somewhat. The new exhaust steam turbine set, was put into use on September 22nd last, and it had been running satisfactorily, and the economy in the coal consumption which resulted fully justified the capital outlay. Every provision had been made for carrying on the business during the coal strike.

Mr. H. A. Hoare seconded the motion, and the report was adopted.

Stewarts & Lloyds, Ltd.—The directors after setting aside £70,000 for depreciation, have (says the *Financier*) declared the following dividends:—Six per cent. per annum on the preference shares for the half-year to December 31st; 10 per cent. per annum on the preferred ordinary shares for the half-year; and 1s. per share on the deferred shares for the year. £70,000 is placed to reserve, and £86,000 is to be carried forward.

O. C. Hawkes, Ltd.—The directors' report states that the net profits, after making ample provision for depreciation, &c., leave an available balance of £6,453. The directors have paid a year's dividend of 5 per cent. per annum on the preference share, and £1,000 is to be added to the reserve fund, making this £33,000, and £1,203 is carried forward. It is expected that the current year's trading will show substantial improvement.

Metropolitan Electric Supply Co., Ltd.

THE directors' report for the year ending December 31st, 1911, states that the capital expenditure has now reached a total of £1,989,832, being an increase during the year of £53,301. The gross revenue amounted to £182,622, as compared with £172,737 in 1910, being an increase of £9,885. The working expenses amounted to £88,005, an increase of £9,722. The balance at the credit of the revenue account, before providing for depreciation, is £94,617. The directors have set aside £17,000 as an addition to the depreciation and reserve fund, which now amounts to £277,355, carrying to the credit of the net revenue account (No. 5) £77,617. This sum, with the balance brought forward, interest and dividends on investments, and other receipts, makes a total of £88,413. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains a balance of £42,357. An interim dividend of 2s. per share (being at the rate of 4 per cent. per annum) on the ordinary share capital, amounting to £20,000, was paid on August 10th, and the directors recommend that a further dividend of 2s. per share (being at the rate of 4 per cent. per annum) on such shares be now paid, making a total distribution for the year of 4s. per share, or 4 per cent. This will absorb a further sum of £20,000 and leave a balance of £2,357 to be carried forward. In order to make provision for capital requirements the directors, under the powers conferred upon them by the Articles of Association and in accordance with the terms of the trust deed of the company's 3½ per cent. mortgage debenture stock, have created a further £190,000 of like stock, of which £43,074 was subscribed for and allotted in the course of the year. The Bill promoted by the company to legalise an agreement with the District Council of Acton for the purpose of acquiring their provisional order, received the Royal Assent on June 30th, and the company is now in possession of the undertaking. The company have acquired a controlling interest in the Brentford Electric Supply Co., Ltd., and have entered into an agreement for supplying that company in bulk. An agreement has also been concluded with the Uxbridge and District Electric Supply Co., Ltd., for a bulk supply in the district of Greenford. Owing to the unsettled state of the transport and coal trades, additions have been made to the large reserves of coal which are always stored at Willesden. These reserves will, it is hoped, enable the company to maintain its supply for fully 10 weeks from the commencement of the coal strike. During the year new connections representing the equivalent of 66,553 8-C.P. (30-watt) lamps, equal to 1,997 KW. were added to the company's system, making a total connection of 957,037 lamps. The stations, machinery and plant have been maintained in a satisfactory condition. The directors regret that Mr. Frank Bailey has resigned his seat on the board.

The meeting is called for March 19th.

Charing Cross, West End and City Electricity Supply Co., Ltd.

THE annual meeting of this company was held on Tuesday, at 60, St. Martin's Lane, W.C., Mr. W. F. Fladgate, M.V.O., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 395), said that last year was certainly a very troublesome one for all undertakings of the kind. For two months they were seriously affected by the strike of August last, during which time they had to pay practically double the price for coal. Of course they had their coal contracts, but they contained the usual strike provisions, and the result was they had to buy coal as and when they could, at any price at which it could possibly be procured. Speaking after many years' life in London, he never expected that one would have lived to see their works, as they did, under the guard of the military forces of the country. Under those circumstances, he was glad to be able to say that the result of the working of the whole year had been of a satisfactory character. In the West End, with the exception of the writing off at Lambeth Station, the figures for 1910 and 1911 were very close. The total revenue of the West End in 1910 was £142,675; last year it was not quite so much—£140,922; but as against that the expenses had dropped from £72,687 in 1910 to £69,408. In each case the same amount of £11,000 had been set aside for depreciation, and the result of the working was that for 1910 they had a sum of £58,987 and for 1911 £60,513. Adding the carry forward and interest earned last year, after paying the debenture interest, they had a sum of £53,849 to be dealt with. Out of that sum they had paid the preference dividend, which absorbed £18,000, and the interim dividend on the ordinary shares, which absorbed £10,000, leaving a balance of £25,949. They had thought it right to keep the dividend at the same rate of 5 per cent., and to carry forward no less than £15,949, which they thought a prudent thing to do having regard to the present state of the labour market, and also to the possibilities of the future. Referring to the Lambeth station, the result of the writing off of that station was, that whereas at the end of last year they had very large reserves, they now brought forward only £84,621, and it would be the care of the directors to consider how, consistently with the rights of the present shareholders, that reserve fund could again be built up. The demand in the West-End for power and lighting was still increasing. The reason of their average price being as low as it was, was that the demand for power and heat amounted to no less than 45·9 of their total. Their transmission losses were better last year, having declined from 28 per cent. to 26 per cent. Referring to the City undertaking, the progress there had been somewhat more satisfactory than in the West End. Their takings for 1911 amounted to £145,071, as against £141,475—an increase of a little over £4,500—while the expenses, which in 1910 were £52,700, only rose to £84,355. They had carried out the same policy in dealing with the net revenue as last year. They had paid interest on the debenture stock and the dividends on the preference shares and the whole of the balance was brought forward to the general revenue account, bringing it up to the respectable sum of £36,158, or an increase of £13,000 odd over the carry forward of last year, which amounted to £23,570. They had not specifically transferred that money to the depreciation account, although they could do so if they thought well later on. In the city the demand for power went on increasing and was now very considerably larger than the demand for lighting. The transmission losses were 26 per cent. as against 27 per cent. last year. Referring again to the Lambeth station, the Chairman gave a history of the undertaking and said that, when the time came for them to consider how they were to deal with it, modern science came to their assistance and they were able to put in modern machinery in their sub-stations by which they were able to generate electricity at a price which, when applied to low tension units, was about 26 per cent. less than they could generate it at Lambeth and transmit to this side of the river. They had, therefore, given up the station and sold the machinery for what it would fetch, which he regretted to say was a very low figure. They had written off £173,562 for the station, leaving a balance of £84,621. He was persuaded that the directors had taken the right course in scrapping the plant there and writing off the loss from their reserves. At the present time the whole of their plant was of a modern and efficient character, and as far as its actual value was concerned, he did not know that it was substantially below that at which it actually appeared in their books. They hoped that for a long time to come they would not want any large expenditure for new machinery—the engineer told him that something between £20,000 and £30,000 was all they would want for some considerable time to come. After mentioning that the Insurance Act would cost the company about £500 or £600 a year, the chairman said that the present position of affairs was one that involved very serious consideration. He was glad to say that they had in their bunkers enough coal to keep them going for five or six weeks, but they could not help feeling that it was absolutely necessary to use the greatest possible care in husbanding their resources as far as possible; whether the strike was going to continue or not it would be foolish for anyone to prophesy. It was a dire calamity, and he hoped that the Government might be able to deal with it in some way to prevent its recurring in the future. The L.C.C. had appointed a Committee to consider the future of the electric supply question. He need not say that they would do their best to look after the position of their company. They had already formed a joint committee of local authorities and the London companies for the purpose of considering what was best to be done, which committee had done a good deal of work. They had considered how far a big bulk supply could be given by completing a trunk line to supply the greater part of London. Personally, he had very great doubts whether that would be a wise course. They did not know the future of electric energy, and he did not look with any favour on any scheme involving a very large amount of capital for the purpose of laying a main which, it might be, would not be wanted at all 10 or 20 years hence.

MR. JOHN M. GATTI seconded the motion.

Replying to MR. MAKINS, the CHAIRMAN said they were trying to raise the price they obtained for their power, and they were succeeding. With regard to the Act of 1908, if it had been passed as an entire Act, a great deal of good would have come out of it, but the most useful provisions of the Act were cut out, and at the time he thought it would be very difficult to work under. A certain amount of progress had been made, and two companies had taken advantage of it. They were endeavouring at the present moment to make use of the Act to get certain economies in working with one or two of the other companies, but there were great difficulties in the way of arriving at any arrangement which would be of any practical use to them.

The report was adopted.

Madras Electric Tramways (1904), Ltd.—The directors' report (says the *Financier*) shows a gross profit of £17,065, plus £853 brought forward, making £17,919. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund, there remains £5,699. The directors propose a dividend of 2 per cent. per annum on the ordinary shares, carrying forward £1,104. The traffic receipts show an increase of 8·49 per cent. upon 1910. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund. The reserve arising from the debenture stock sinking fund now amounts to £3,830. The two extensions referred to in previous reports are being constructed and will be opened for traffic in the autumn. These extensions are being financed by temporary loans, but it is proposed, as soon as the lines have been opened to make a further issue of debenture stock and shares to repay the loans and to provided further working capital.

Western Telegraph Co., Ltd.—The directors have declared a second quarterly interim dividend of 3s. per share, free of income tax, being at the rate of 6 per cent. per annum.

Cuban Telephone Co.—The directors have declared a dividend of 1 per cent. for the quarter ending March 31st.

Direct Spanish Telegraph Co., Ltd.

The directors' report for 1911 shows that after providing for interest on and redemption of debentures, and for the dividend on the preference shares there is a balance of £8,326. Of this, £5,000 has been transferred to the reserve fund, the directors have distributed a bonus to the company's staff in celebration of the Coronation of H.M. King George V., costing £704, and they now recommend the payment of a final dividend for the half-year ended December 31st, 1911, at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, amounting to £1,293, making, with the interim dividend paid on October 1st, 1911, a total distribution of 4 per cent. for the year. The balance, viz., £36, is to be carried forward. Compared with 1910 the traffic receipts show an increase of £195, and the working expenses an increase of £144.

The Bilbao cable became interrupted on June 28th last, and was promptly repaired by the cable steamer *John Pender*, communication being restored on July 1st. The cost of this repair, viz., £4,125, has been charged to revenue. In view of the recent extensive breaks of the Bilbao cable, which was laid in 1884, and the great inconvenience caused thereby to the company's customers, the directors considered it necessary to thoroughly repair that cable, including a new shore-end at the Spanish landing place at Arrigunaga. This work was successfully carried out by the Eastern Telegraph Co.'s cable steamer *John Pender* in September, 1911, the interruptions to communication during the progress of the operations lasting 10 days. The cost of this work, viz., £38,060, has been placed in suspense, and it is the intention of the board to gradually write the sum off the reserve fund. Since the last report of the directors, the transfer of the company's telegraph station from Falmouth to Kuggar (Cornwall) has been completed, and the new overhead system works satisfactorily. The company's old underground line between Falmouth and The Lizard, laid in 1881, having been taken out of circuit, the original cost of the line, viz., £2,710, has been deducted from the capital expenditure account, and the cost of the land purchased by the company at Kuggar, and the new telegraph station erected thereon, has been added to that account. The directors report with extreme regret the death of the Marquis of Tweeddale, K.T., who had been chairman since 1896. Sir John Denison-Pender, K.C.M.G., has been elected chairman. Sir Albert James Leppoc Cappel, K.C.I.E., has joined the board.

County of London Electric Supply Co., Ltd.

Mr. J. B. Braithwaite presided at Winchester House, E.C., on Monday, at the meeting of this company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 396), said he told them last year that he would be disappointed if they did not have considerably improved results to show them for the year upon which they were then entering, and he was happy to say that that hope had been fully realised. So far as the balance-sheet was concerned, they would find that the capital expenditure upon their undertaking had been increased during the year to the extent of £49,000. The actual expenditure had been about £67,000, but they had written off obsolete machinery to the extent of £18,000, so that the net increase appearing in the balance-sheet was £49,000. Of that capital expenditure, 55 per cent. was on mains, and they did not put in new mains unless they had the customers waiting to take the supply from them, therefore every penny they spent on mains became immediately remunerative. During the year they had added 1,576 new customers, making their total consumers at the present moment 18,459. The capital expenditure had been provided by selling the balance of their first debenture stock, of which there was on last year's balance-sheet £10,000 odd unsold, and the additional £50,000 of second debenture stock which was authorised some time ago. That provided them with about £60,000 additional capital, and the balance had been made up by a slightly increased loan from their bankers. That was the only change in the balance-sheet so far as the capital was concerned. With regard to revenue, the gross revenue showed an increase of £24,618 for the year, being 13·14 per cent., and that compared with an increase last year of £10,118, or 5·7 per cent., so that they would see their gross increase of revenue for the past year was nearly 2½ times what it was for the previous year, and the percentage of increase had risen from 5·7 to 13·14, which, he thought, was thoroughly satisfactory. As a matter of fact, their increase was the largest of any of the London electric supply companies, and by a considerable amount. The next one to them was the London Electric Supply Co., but a great portion of their increase was due to their supplying current to the Brighton Railway. Turning to the net revenue, of the £24,618 gross increase they had succeeded in retaining £15,298 as net, or at the rate of 13·79 per cent. increase. That was, he thought, a very satisfactory feature, in view of the railway strike in August last, which naturally cost them something in increased cost of coal and other matters, and augured well for the continuance of their prosperity. As a matter of fact, the percentage of their works cost to their gross receipts again showed a small decrease this year, in spite of the extra cost they had had to pay for coal during the railway strike. The figures for the last three years would perhaps interest them, they would then see the steady progress they were making. In 1909 their working costs were 41¼ per cent. of their revenues. In 1910 that figure had fallen to 40·4 per cent. About £3,000 of the increased revenue had been absorbed by increased capital charges. In the course of three years they had increased the amount placed to depreciation from £16,000 to £25,000 per annum, and they hoped to make further additions to it in the future. Then they had raised the sum carried forward by £1,774, and they were giving them £4,000 more in the way of dividend on the ordinary shares, raising the dividend for the year from 5 per cent. to 6 per cent. If they came to analyse the expenses account, there were one or two points which were of interest. For instance, one of the great increases in their expenses for the past year had been in the item of rates. They had to pay £1,980 more in rates than they had in the previous year. The only other really important difference in the expenses was in the cost of generation, that had cost them £4,824 more, of which about £1,350 was due to the railway strike and the balance was due to their increased business. They had also made a larger provision to their reserve for bad debts to the extent of £1,000, which was merely a matter of prudence, which he was sure they would approve. They sold during the past year 20,450,787 units, showing an increase of 3,465,100 units over the previous year, or 20 per cent. For lighting they sold 7,161,234 units, and for power 13,289,553 units. It was near enough to say that one-third of their output had been used for lighting and two-thirds of it for power. With regard to lighting, what he had told them on previous occasions had turned out to be correct. They might remember that when the metallic-filament lamp was first introduced there was a tendency on the part of some of the companies to take fright at the large reduction in their current consumption. They had always taken the other line, feeling sure that any invention which tended to decrease the cost of electricity was bound to tell in their favour, and that expectation had been verified. As to motive power, he thought those manufacturers who were dependent upon their, and other, electric companies for their supply were rather to be envied at this time of stress while the coal strike was going on. They had stored a large quantity of coal, and unless the strike should last a very abnormal time, he hoped that at the end they would be able to say that they had not had to reduce their supply to any of their customers. Regarding the future outlook, up to the present moment the lamps applied for this year were equivalent to 995 kw., as compared with 340 kw. for the corresponding period of last year—nearly three times as many. They could not expect that rate of increase to continue—probably part of it was due to the coal strike. As regarded units sold, they showed an increase of 9 per cent. so far this year, and in cash revenue they showed an increase of 4½ per cent. gross, and 5 per cent. increase in net earnings. There was, therefore, every indication that, subject only to labour troubles or unforeseen circumstances, they were entering upon a year of even greater prosperity than the one just completed. With regard to their subsidiary companies, Bournemouth was just maintaining its dividend, but at Coatbridge very great progress had been made. There had been an increase of 31 per cent. in the units sold, and an increased profit of £2,493. Since last year they had effected the inter-connection of their City Road and Wandsworth stations, and now they could transmit current from one to the other. That gave greatly increased security to their consumers, and, at the same time, it should lead to considerable economy in the consumption of coal.

Mr. J. Shaw, K.C., seconded the motion.

Replying to Mr. Makins, the Chairman said they were taking the fullest possible advantage of the 1908 Act, and at the present time they were in negotiation with other electric supply authorities to give them a bulk supply.

The report was adopted.

National Telephone Co., Ltd. (In Liquidation).—The following is the supplemental report of the directors for the half-year ended December 31st, 1911:—"The income accrued in respect of the business of the half-year amounts to £1,872,258, as compared with £1,744,111 for the corresponding period of 1910, an increase of £128,146. The working expenses for the half-year amount to £1,050,047, as compared with £1,015,443, an increase of £34,604. The net result for the half-year (after deducting the Post Office royalties amounting to £179,362) is a profit balance of £642,850, as compared with £561,056 for the corresponding period of 1910, being an increase of £81,794. The rentals carried forward for unexpired terms of running contracts amount to £1,474,569, as compared with £1,413,376 at the corresponding period of 1910, being an increase of £61,193. Of the amount of £520,286 shown by the net revenue account, £218,750 has been absorbed by the dividends paid on January 9th, 1912, in respect of the half-year ending December 31st 1911. The balance of £301,536 has been transferred to the reserve fund account, bringing the total of that fund to £4,645,944. £150,256 has been expended on capital account during the half-year in the erection of 11,428 additional exchange and private stations, and in the construction of underground works. On January 29th, 1912, £3,000,000 was received from H.M. Postmaster-General on account of the purchase money in respect of the plant, property and assets of the company acquired by him, and arrangements were made for the repayment on the same date to the debenture stockholders of the whole of the outstanding 3½ per cent. and 4 per cent. debenture stocks of the company. The board have to lament the death of their esteemed friend and colleague, Mr. George Hunter Robertson, of Liverpool, which occurred on February 7th last. They desire to place on record their high appreciation of the valuable services which he rendered to the company from the very early days of the telephone enterprise."

Cambridge Electric Supply Co., Ltd.—Mr. D. Munsey presided at the annual meeting held on February 27th. He said that the company was in a very satisfactory condition. During the year they had made a bigger stride than ever before in their 20 years' existence. Meter charges were reduced from 10s. to 6s., and as the result of nine months' experience they had lost £100 by that arrangement, but it would help business in the long run. They were in a very strong position respecting coal.—Mr. A. A. C. Swinton, in seconding, said that they were beginning to see the other side of things; the effect of the reduced revenue due to the metal lamps was passing away, and before long they would have as much revenue as before. Their basis would be stronger with more consumers at lower prices.—The report was adopted.

Gateshead and District Tramways Company.

The directors report that the total revenue for 1911 amounted to £55,982 and after deducting all expenses chargeable to revenue, including repairs and maintenance, interest on mortgages, and £2,743 placed to renewals account, there remains a profit on the year's working of £22,420, plus £848 brought forward, making £23,268. Of this there is to be placed to the reserve fund £4,500, to sinking fund for redemption of mortgages £2,033, to dividend on £12,610 6 per cent. preference shares £757, to dividend on £120,000 5 per cent. preference shares £6,000, to dividend on ordinary shares at the rate of 6 per cent. per annum, in respect of which an interim dividend for half-year ended June 30, 1911, at the rate of 5 per cent. per annum was paid in September, £8,100, carried forward £1,878. Interest derived from investments has been added to the reserve fund and renewals account. After the above appropriation the total at credit of reserves, renewals and sinking fund accounts will be £51,932. The expenditure chargeable to the capital account during the year amounted to £1,346 13s. 8d., making the total £334,389. The general trade of the district was satisfactory during 1911, and the traffic receipts consequently show a gratifying increase. The net profit is substantially higher but in view of the present unrest in the industrial world, the directors considered it advisable that the amount carried forward should be increased. Meters were fixed to the cars during the latter part of the year and have resulted in a reduction in the quantity of electricity used. Satisfactory arrangements have been made with the P.A.Y.E. London Syndicate, Ltd., for the conversion experimentally of the nine cars operating the Bensham and Saltwell routes to the pay-as-you-enter system. Most of the important tramway undertakings in Canada and America have adopted the system with advantage, and it is hoped that equally satisfactory results may be obtained in this country.

	1910.	1911.
Number of passengers carried	12,061,249	12,705,177
Average receipts per passenger	1·03d.	1·02d.
Average expenditure per passenger ..	·56d.	·55d.
Proportion of expenses to receipts ..	54%	54%
Number of Cars in Stock	52	51

The route mileage is 12·16 miles.

British Electric Transformer Co.

The annual meeting was held on Friday last at Salisbury House, E.C., Mr. J. F. Albright presiding.

The Secretary (Mr. J. C. Wrist), owing to the indisposition of the chairman, read the speech which that gentleman had prepared. In this the chairman said that on the asset side of the balance-sheet there had been an addition of £4,956 for freehold land, buildings, plant, &c. That was expenditure in connection with some extensions recently carried out to their works at Hayes, which were rendered necessary by the expansion in the business during the past year. The increase in investments of about £6,000 was due to the fact that they had invested some of their spare cash in railway debentures, which could, of course, be readily realised when they were requiring further cash for the purposes of the business. The reserve account stood at about £7,886, and they proposed adding this year a further £7,000 to this item, making a total reserve of £14,886. Although they had not earmarked this reserve account in the balance-sheet, they would now have a substantial reserve against patents, goodwill, and other contingencies. The directors were of opinion that it was the safest and best policy for the company to build up a reserve as much as possible in what he might term these times of prosperity, and so put the concern on as sound a financial basis as possible, rather than pay away unduly large dividends. The 10 per cent. was decided upon as the ordinary dividend because it was considered the least the shareholders could be fairly offered after such a prosperous year. Summing up the report and comparing it with last year, they would see the profit was 63 per cent. more; they were paying 66 per cent. more to the ordinary shareholders; they were transferring 40 per cent. more to reserve, and were carrying forward 145 per cent. more. He trusted that they would consider this result satisfactory. They had been doing a considerable and increasing amount of manufacture of "Tricity" cookers during the past year. He was of opinion that there was a growing demand for this class of apparatus, the orders coming in in a steady manner from all parts of the world. They had come to the conclusion that the "Tricity" business could be more rapidly and advantageously developed if the company had the sole rights in connection with it, and it was partly with that object that he would ask them presently to pass a resolution increasing the capital. The directors felt that it was most necessary in the best interests of the company to broaden the basis of its manufactures, and they believed that the additional turnover which might be reasonably expected from the sale of the "Tricity" cookers should in the future form such a source of revenue that the profits earned for the past year could be maintained or even augmented. As regarded the general prospects of the business he had no wish to prophesy, but he might tell them as a matter of fact that the year 1912 found them with more orders in hand than did the year 1911, which had been a record year.

Mr. G. Berry, in seconding the resolution, said that in regard to the business of the past year, the most important development had been that due to the manufacture of "Tricity" cookers, nearly 4,000 of which were, he understood, in use. The demand increased very rapidly during the year, and for the last six months was nearly double that of the preceding six. The increase continued, doubtless, owing to the recommendation of satisfied users. The ever-increasing price of coal, taken with the diminishing supplies magnified this matter into one of national importance. It had been computed that if the present electric light users alone were enabled immediately to install "Tricity" cookers in place of coal ranges for cooking, a saving of several million tons would result annually.

The report was adopted.

At a subsequent extraordinary general meeting the following resolution was carried:—"That the capital of the company be increased from £120,000 to £200,000 by the creation of 50,000 new 6 per cent. cumulative preference shares and 25,000 new ordinary shares of £1 each."

The proceedings then terminated.

Windsor Electrical Installation Co., Ltd.

The directors report that during 1911 the capital expenditure amounted to £1,039, making the total £90,350. The additional expenditure represents extensions of mains, also the purchase and equipment of machinery erected at the company's transformer station at Eton for regulating the supply of current taken in bulk from the Slough and Datchet Electric Supply Co., Ltd. The profit for the year (including £357 brought forward) is £6,718. Of this, debenture interest absorbs £797; dividend on 5 per cent. preference shares, £1,108; depreciation, renewal, and reserve fund, £1,750; and directors' fees, £350; leaving a balance available for dividend on the ordinary shares of £2,712. Out of this the directors recommend that a dividend of 4½ per cent., less income-tax, be paid on the ordinary shares, and that £593 be carried forward. By setting aside £1,750, the depreciation, renewal and reserve fund will amount to £17,000, and the directors now recommend that this fund be further raised to £18,000 by the transference of £1,000 from the dividend equalisation account, and that the balance of £450 of the dividend equalisation account be transferred to the credit of the free-wiring account. During the year new lamps were connected equivalent to 2,414 of 8 c.p., the total connected being 50,055 lamps.

W. T. Glover & Co., Ltd.—The directors' report for the year ending December 31st, 1911, shows that the result of the trading is a credit balance of £33,453, plus £5,521 brought forward = £38,975. From this are deducted:—Directors' remuneration, voted March, 1911, £1,000; directors' expenses during 1911, £63; interest at 4½ per cent. on first mortgage debenture stock, £4,250; interest at 5 per cent. on second mortgage debenture stock, £3,800: written off investments, as per balance-sheet, £775; leaving £29,087, less appropriation for payment to trustee of second mortgage debenture stock, £4,000. It is proposed to pay the dividend on the 5 per cent. cumulative preference shares (£100,000), less income-tax, absorbing £4,708 to transfer to first mortgage debenture redemption fund, £2,500; to pay a dividend on ordinary shares (£114,850) at the rate of 5 per cent., less income-tax, requiring £5,407; to pay a bonus on ordinary shares, at the rate of 2½ per cent., less income-tax, £2,704; transferring to reserve fund, £5,000, and carrying forward £4,767. The directors have pleasure in recommending the payment of the dividend on the 5 per cent. cumulative preference shares for the year ending December 31st, 1911, and also the payment of a dividend at the rate of 5 per cent. and a bonus at the rate of 2½ per cent. on the ordinary shares for the same period. After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £30,500, the redemption fund for the second mortgage debenture stock at £20,000, and the reserve fund at £15,000. The meeting will be held at Trafford Park on March 18th.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Cuban Telephone Co.—Further issue of £120,000 5 per cent. first mortgage convertible bonds (Nos. 2,001 to 2,500 of £200, and 9,414 to 9,613 of £100 each).

Montreal Water and Power Co.—Further issue of £25,000 4½ per cent. first mortgage prior lien gold bonds of £100 each (Nos. 8,698 to 8,947).

Greenock and Port Glasgow Tramways Co.—The directors report that the total revenue for the year 1911 amounted to £38,949. After deducting all expenses, including interest, payments to Corporations, and the provision of £2,250 for renewals account, the available balance is £13,298, as against £9,445. The directors recommend (says the *Financier*) carrying to reserve sinking fund for loan redemption £1,776, to depreciation and reserve account £1,200, to dividend at the rate of 5 per cent. per annum on the preference shares £3,500, to dividend at the rate of 5 per cent. per annum on the ordinary shares £5,750, carrying forward £1,072.

Vickers, Ltd.—The directors recommend a final dividend of 1s. per share (free of income-tax) on the ordinary shares, making 2s. per share, or 10 per cent., for the year, writing off £100,000 from goodwill and patents account, and carrying forward £205,031.

Hadfield's Steel Foundry Co., Ltd.—For the year 1911 the directors recommend that in addition to the interim dividend of 1s. per share paid in August last on the ordinary shares (£1 each) a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 6d. per share (all free of income-tax), carrying forward the balance of £46,758.

New Issue.—The Consolidated Gas, Electric Light and Power Co., of Baltimore, is now offering $700,000 ordinary stock to existing holders at par.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	5½d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£22 15	5/- dec.
a Lead, Nitrate	„	£25	..
a „ White Sugar	„	£35	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (80/82 %) ..	per ton	£20 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3¾d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£67	£2 inc.
b „ Wire, in ton lots ..	„	£102	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	..
c „ Tube (brazed)	„	10¼d.	..
c „ „ (solid drawn) ..	„	8½d.	..
c „ Wire, basis	„	7½d.	..
c Copper Tubes (brazed)	„	10½d.	..
c „ „ (solid drawn) ..	„	10d.	..
g „ Bars (best selected) ..	per ton	£80	£1 inc.
g „ Sheet	„	£80	£1 inc.
g „ Rod	„	£80	£1 inc.
d „ (Electrolytic) Bars ..	„	£68 5	£2 inc.
d „ „ Sheets ..	„	£85 5	£2 inc.
d „ „ Rods	„	£78 5	£2 inc.
d „ „ H.C. Wire	per lb.	8½d.	1/32d. inc.
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	4/10½	3d. inc.
f Iron Pig (Cleveland warrants) ..	per ton	50/2½	11½d. inc.
l „ Wire, galv. No. 8, P.O. qual.		£14	..
g Lead, English Pig	„	£16 5	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 12 6	5/- inc.
e Mica (in original cases) small ..	per lb.	6d. to 2s.	..
e „ „ „ medium	„	2/6 to 4/-	..
e „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½.	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£194 to £196	£3 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8½	1d. dec.
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£29 15	12/6 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

With every day bringing new aspects of the coal-strike position into focus, it is very difficult to write upon matters to which the subject is cognate, when, by the time the paper is in the hands of the reader, the whole state of affairs may have altered. The Stock Exchange remained fairly confident all through, putting prices better after the strike had actually broken out, and giving the bears rather a bad time in all the markets. In Home Rails, of course, the labour situation has dominated everything else; but, so far as the electrical stocks are concerned, other factors have been at work to which even the coal strike influence was subservient.

Central London Ordinary parted with 4 points of the 9 which it gained last week, and the Deferred stock fell 2, against the rise of 4 previously. City and South London Ordinary shed 3, and Metropolitans went back 1¼, which is, of course, not much after their sharp rise of last week, amounting to 8¼ points. Districts retained their improvement, but the whole market is less enthusiastic about the amalgamation prospects, upon the strength of which prices were rushed up so sharply quite recently. Underground Electric Railways are unchanged. The dislocation of traffic on many of the steam lines has not spread to the electrically-worked companies so far, which is a tribute to the management that had the foresight to lay in sufficient stocks to maintain full services for at all events some time.

British Electric Traction issues are a little easier, the two Preferred and the 6 per cent. Preference stocks going back to some extent. There has been a rise in Great Northern and City Preferred Ordinary, which caused the price to harden to 35s. middle. Beyond these alterations, the list is comparatively colourless.

Surprise has been occasioned that Electricity Supply shares of the London companies should have remained so steady at the time when their coal supplies were threatened. As a matter of fact, changes have been rather in favour of holders during the past fortnight than against them, and this week the tendency is still the same. Chelseas rose 5s. to 4¾, but the main rise is that secured by City of London Ordinary shares, the price at 15 showing a rise of 22s. 6d. County Preference hardened a little, and London Electric Preference have also improved. Metropolitans went back ¼, these being the only shares in this department to show a decline on the week.

There is an idea current in some quarters that the buying of City of London Ordinary shares may be connected with the fact that the Corporation has the right to take over the undertaking in 1914 upon special terms as applied to the private and public parts of the concern. Rumours of negotiations are also in the air, to the effect that the Corporation means to buy up the concern in advance, if necessary, and the price is talked to £20 per share. What truth there may be in both these rumours it is impossible to say, but the buying has certainly been of the class commonly called "knowing," and the jobbers have been rather badly caught out of shares.

Shareholders in the Brompton and Kensington Company are asking for information with regard to the subsidiary, which it was suggested in the report should be formed, in order to comply with the limitations of the company's provisional order. Up to the time of writing, nothing has transpired with regard to this, but it is not unnatural that Broptmon proprietors should be enquiring as to what they may expect.

Affairs in Mexico have been very unsettled, and all kinds of rumours got into circulation as to the amount of damage the revolutionaries propose to do to the various companies of the power, lighting and similar descriptions. These reports had the effect of bringing out a certain amount of stock, but, on the whole, the movements are insignificant. Mexican Light and Power Preferred fell 1, and the First Mortgage bonds ½. Mexico Trams are ½ down, and the bonds are also a little lower. Monterey Debentures lost a similar amount. Apart from Mexicans, the group in general is steady to firm. Rio Trams rose 1½, Sao Paulo Debenture hardened to the same extent, and the shares advanced to 200. Shawinigan Capital stock put on ½, and Cordoba 5 per cent. Debentures gained a point. British Columbia issues are better, the chief gain being 2 points in the company's Preferred Ordinary stock. There are a few other movements of ½ to 1—some up, some down—but none of them possess any particular importance. The investor is still putting money into these foreign securities, his suspicion of the home-grown articles being emphasised by the uncertainty and the depression brought about by the coal strike and the prospects which open from the contemplation of the power which the Trade Unions wield.

The Telegraph market is distinguished by fresh rises in Marconis, in which the Canadian and Spanish Companies' shares have participated. Indeed, Canadian Marconis are perhaps the feature of the week, suddenly rising from 18s. to 28s. within the course of a few days. The special settlement in the shares takes place next week. Spanish Marconis at 1⅞ are better, while the parent company's shares at 4¾ buyers are 1/16 higher. West India and Panama fell back to 4¼, and the Preference also show a tendency to dwindle. The Anglo group is only fairly steady, Anglo Deferred being ¼ off. There has been a sharp drop in Eastern Telegraph Ordinary on account of a mild recurrence of the Marconi fever which demoralised the market so badly a few years ago, and from the effect of which it has never wholly recovered. Eastern Extensions fell ⅛; Globe Ordinary and Preference both gave way, all for the same reason. Cuba Telegraphs are ¼ lower, and Direct United States ¼ down; while amongst Telephone descriptions the only important alteration is a rise of 3½ in National Telephone Deferred, this bringing the price to 128 middle. The Third Preference hardened to 5⅛.

Manufacturing issues are not much affected this week by the labour troubles. British Insulated remain at 7, the dividend declaration being at the usual rate of 6s.—making 10 per cent. for the year. Henleys rose 10s., but India-Rubbers went back a trifle. The buying of Babcocks was resumed, with the result that the price recovered to the tune of ¼, being up to 6¾ again. The Rubber market is decidedly strong, and the demand for the commodity at this week's Mincing Lane sales was sufficiently good to put a bright complexion upon most of the share prices in the Stock Exchange.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 12th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	8¼ — 9¼	..	5 18 11
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	10 — 102	..	4 8 3
Brompton & Kensington, Ord...	5	10	9†	8¾ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	7¾ — 8¼	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	4 — 4½	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4¾	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅜ — 4½	..	5 9 1
Do. Do. 4 % Deb... ..	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4½ — 5	+ ½	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	14½ — 15½	+1½	5 3 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord... ..	10	5	6	9⅝ — 10⅛	..	5 18 5
Do. 6 % Pref.	10	6	6	11½ — 11¾	+ ⅛	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	101 —104	..	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 3⅛	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	87 — 90	..	5 0 0
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1⅞ — 1¾ xd	..	3 18 2
Do. 6 % Pref.	5	6	6	4⅜ — 5 xd	+ ⅛	6 0 0
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	+1	4 6 0
Metropolitan	5	5	4†	3⅜ — 3⅝	— ¼	6 3 1
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum. ..	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	5 9 1
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6⅞ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	2	1¼ — 1⅝	..	..
South London, Ord.	4	5	5	2¼ — 2½	..	..
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref...	1	7	7	1 — 1⅛ xd	..	6 4 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	5	5	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	8¼ — 8⅝ xd	..	5 16 0
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5¼	+⅛	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞ xd	..	5 2 2
Calcutta, Ord.	5	8½	7†	6½ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	4½ — 5 1/16 xd	..	4 16 10
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 3
Canadian Gen. El. Com. ..	$100	7	7†	114 —118	..	5 18 8
Do. 7 % Pref.	$100	7	7	116 —120	..	5 16 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	96 — 99	+1	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ — 94½ xd	..	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/32	— 1/32	Nil
Do. 6 % Pref.	1	6	6	⅞ — ⅞	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	108 —110	..	4 11 0
Madras, Ord.	5	..	..	2⅜ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	—1	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84 — 86	..	5 16 3
Mexican Lt. & Power, Common	$100	4	4†	82 — 84	..	4 15 3
Do. 7 % Cum. Pref.	$100	7	7	104 —106	—1	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	..	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	— ½	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	192 —197	..	3 11 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	..	248 —258	—2	3 17 6
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	+1	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	+1	4 7 5
Shawinigan Water, Capital ..	$100	4	5†	129 —131	+ ½	3 16 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ —105½	..	4 5 4
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref. ..	1	Nil	11¼d.	⅛ — ⅛	+ ⅛	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½ —106½ xd	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†.	7½ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97⅞ — 99⅝	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150	..	5 5 6
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph ..	Stock	3½	3	66 — 68	..	4 8 6
Do. 6 % Pref.	Do.	6	6	110 —111	..	5 8 1
Do. Def.	Do.	30/-	30/-	25⅜ — 25⅞	— ⅛	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100 —102 xd	..	4 18 0
Chili Telephone	5	7	..	7¼ — 7⅜	..	4 13 4
Commercial Cable, Stig. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	10 — 11	— ½	5 6 8
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable ..	10	4½	..	7¼ — 7⅜	— ¼	5 16 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	129 —133	—6½	5 5 3
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	82½ — 84½	— ⅜	4 2 10
Do. 4 % Mort. Deb.	Do.	4	4	100½ —102½	..	3 18 1
Eastern Extension	10	7	5†	13 — 13½	— ⅜	5 3 8
Do. 4 % Deb.	Stock	4	4	99½ —101½	..	3 18 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	5⅞	6†	10⅜ — 11½	— ⅛	5 6 8
Do. 6 % Pref.	10	6	6	12⅜ — 13½	— ⅜	4 10 7
Great Northern Telegraph ..	10	18	5†	84 — 89	..	5 9 1
Indo-European Telegraph ..	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common ..	$100	5	5†	83 — 86	..	5 16 8
Do. 4 % Cum. Pref.	$100	4	4	71 — 74	..	5 8 1
Marconi's Wireless Telegraph	1	5	..	4 1/16 — 4 1/8	+ 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	4⅜ — 4½	+ 1/16	..
Monte Video Telephone, Ord. ..	1	6	6	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	5 10 6
National Telephone, Pref. ..	Stock	6	6†	90½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	127 —129	+3½	4 13 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	.. ..	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5½	+ 1/16	4 15 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	103 —104	..	4 6 6
Oriental Telep. and Elec. ..	1	8	..	1⅜ — 1⅝	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅝	..	4 16 10
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98½ —100½	..	3 19 7
Reuter's	8	5	5†	10⅜ — 11½	..	3 10 11
Submarine Cables Trust ..	Cert.	6	6	180 —188	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1½ — 1⅝	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	+ ½	4 0 5
West India and Panama Teleg.	10	1¼	1¼†	4⅛ — 4⅜	— ⅛	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜ — 11½	— ⅜	5 6 8
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅛ — 10⅜	..	5 6 8
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd. ..	10	7	6†	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds.. ..	$1000	4½	4½	102 —105	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations March 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅛ — ⅜	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — ½	+1/16	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	13½ — 15½	+ ½	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	91½ — 93½	— ½	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 41	—1½	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	73 — 75	—4	4 0 0
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	60 — 62	—2	3 4 6
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1½	1⅝	34 — 36	—3	4 10 3
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	102 —104	..	4 16 2
Do. Do. 1901	100	5	5	101 —103	..	4 17 1
Do. Do. 1903	100	5	5	101 —103	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅞ — 11⅞	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 1⅜	+ ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅜ — ½	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2¾	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅜ — 4⅛	..	..
Do. 4 % Deb.	100	4	4	75⅛ — 78⅛	..	5 1 11
Metropolitan Railway Consol.	* 100	1⅜	1⅜	56½ — 57	—1¼	3 5 9
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	..	3 18 7
Do. 3½ % Deb.	100	3½	3½	89 — 91	—1	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	35¼ — 36	..	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3¾	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	5†	3⅞ — 3¾	..	5 13 6
Do. Def.	1	Nil	..	3⅜ — 3⅝	..	Nil
Do. 5 % Pref.	1	5	5	3⅞ — 3¾	..	5 10 2
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½—102½	..	4 17 7
Potteries, Ord.	1	2	..	1⅜ — 1⅞	..	..
Do. 5 % Pref.	1	5	5	3⅜ — 3⅝	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	⅜ — ⅝	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	2⅜ — 2⅝	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Income	100	1	1½†	78 — 80	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	..	2¼ — 3¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5⅓	5 1/16 — 5 5/16	+1/16	5 3 6
Do. 2nd Pref.	5	5	5⅓	4 13/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	101½—103½	..	4 7 0
Do. 5 % Deb.	100	5	5	103½—105½	..	4 14 9
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	8½ — 9	..	4 8 11
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	135 —140	..	5 14 4
Do. Pref. Ord.	100	6	6	118 —122	+2	4 18 4
Do. 5 % Pref.	100	5	5	109½—112½	+ ½	4 8 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	104 —106	..	4 5 0
Calcutta Trams, Ord.	5	6	..	5⅛ — 5⅜	..	5 4 4
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	—1	4 8 3
Cape Electric Trams	1	Nil	2½†	⅜ — ½	..	..
City Buenos Aires Trams (1904)	5	5	5	5 5/16 — 5 1/16 xd	..	4 6 0
Do. 4 % Deb.	100	5	5	101— 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 9/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	—2	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	31/32 — 35/32	..	..
Do. Pref.	1	6	6	31/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	100	5	5	95½ — 97½	+1½	5 2 7
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	+1	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101½	..	4 18 6
Mexico Trams Com.	$100	7	7†	117 —119	— ½	5 17 8
Do. Gen. Con. 5 % Bonds	..	5	5	96½ — 98½xd	—1½	5 1 6
Do. 6 % Bonds	..	6	6	100 —102	— ½	5 17 8
Para Elec. Rlys. & Lt., Ord.	5	10	10	6¾ — 7⅛xd	— ⅛	7 0 4
Do. 6 % Pref.	5	6	6	5 — 5⅛xd	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅞ — 1⅞	..	1 18 1
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5⅓	— ⅛	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	119¼—120⅝	+1½	4 3 0
Do. 1st Mort. 5 % Bonds	..	5	5	102⅜—103⅜	+ ¼	4 16 5
Do. 5 % Mort. Bonds	100	5	5	99 —100	..	5 0 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	199 —201	+1	5 19 6
Do. 5 % 1st Deb.	$500	5	5	103¾—105½	+1½	4 14 9
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5⅛ — 5⅜	..	6 1 9
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	+1	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105 —107	..	4 4 1

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ¾	..	..
Do. 6 % Pref.	1	9	6	2⅞ — 3⅛	..	7 2 2
Babcock & Wilcox	1	96	24†	6⅝ — 6¾	+ ⅛	3 15 7
Do. Pref.	1	6	6	1⅝ — 1⅞	..	3 13 10
B.I. & Helsby Cables	5	10	10†	6¾ — 7⅛	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95 xd	..	4 13 9
British Westinghouse, Pref.	3	Nil	..	⅜ — ½	..	Nil
Do. Deb.	100	4	4	61 — 64	—1	6 5 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — ¼	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	54 — 59 xd	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	8¾ — 9⅛	..	7 17 11
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	98⅜ —100⅜	..	4 9 7
Castner-Kellner	1	17½	20	3⅜ — 3⅝	..	5 10 4
Do. Deb.	100	4½	4½	106 —110	..	4 1 10
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 3¼	..	5 8 1
Do. Pref.	1	6	6	3⅜ — 1 3/32	..	5 9 9
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/16 — 2/16	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	⅜ — 1	..	..
Do. Pref.	2	7	7	1 3/16 — 1 5/16	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	87 — 92	..	4 7 0
Henley's, Ord.	5	15	10†	12¼ — 13	+ ½	5 15 5
Do. Pref.	5	4½	4½	5 — 5⅛ xd	..	4 5 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9⅜ — 10⅜	— ½	..
Do. Pref.	10	5	5	9⅛ — 10⅛	..	4 17 7
Telegraph Construction	12	20	10†	8⅝ — 8⅞	..	6 7 0
Do. Deb.	100	4	4	99½ —101½	..	3 18 10
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1⅛ — 1⅜	..	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

ELECTRIC POWER IN A JAPANESE SHIPBUILDING YARD.

The marvellous development of Japan has ceased to be a nine days' wonder, and engineers in the Western world are now prepared to accept the fact that in the Far East the centres of industry have developed considerably, and will, in every probability, have to be reckoned with as closely by European engineers as Germany, which is giving the world an example of what modern competition means. It is, perhaps, a matter of some pride to British engineers that Japan owes much to Englishmen for initiating the forward movement, which has done so much in placing Japan in the forefront of the nations in an engineering as well as in a political sense. In no department of engineering is this more manifest than in that of shipbuilding and the allied engineering industries. Japan is similar to Great Britain in the fact that it owes its position among the world powers very largely to its naval strength, and this has involved a steady policy on the part of the Japanese Government towards the concentration of ship-building activity so far as possible within its own realms. Not many years ago the Japanese Navy was largely constructed in Great Britain; but it is doubtful whether the large shipbuilding enterprises in this country, gigantic though they are, and equipped for the cheap and rapid construction of warships of the largest sizes, are getting the same number of orders for Japan as they were in former times. This is a perfectly natural outcome of the internal develpment of Japan, and reflects no discredit whatever upon British industry. An encouraging feature of the situation is that, although the actual position of manufacture is changed to a considerable extent, there are interests and alliances, both in the commercial and political world, which operate favourably towards the maintenance of a strong mutual interest and sympathy between engineers in Great Britain and Japan.

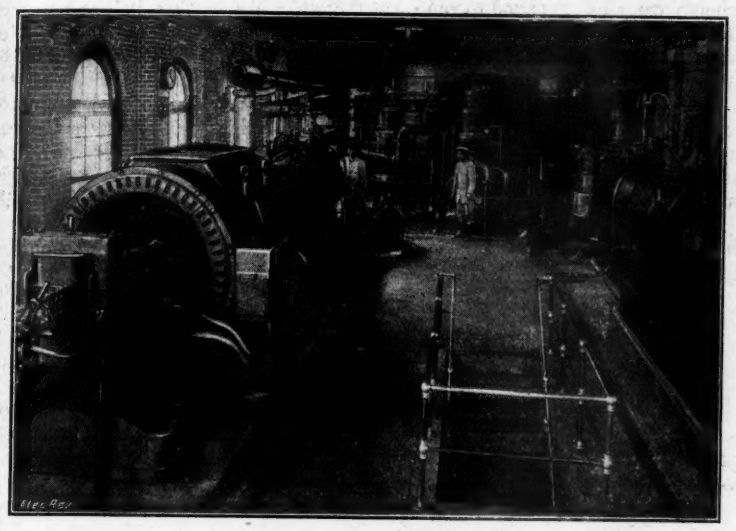


Fig. 1.—Central Power House, Akunoura Engine Works, Japan.

This being the case, it is of advantage to refer to what is probably one of the oldest shipbuilding firms in Japan, and one which certainly stands in the forefront of Japanese marine engineering enterprises, the Mitsu Bishi Dockyard and Engine Works. This resembles our own great shipbuilding and marine engineering works, such as Vickers, Palmer's, and Armstrong, Whitworth's, in that it is capable of dealing with the construction of warships and vessels of the merchantile marine, right away from the raw material to the finished ship, with the exception, perhaps, of such patented manufactures as are only made by firms possessing patent rights. Even here the firm mentioned has made arrangements with some of the outstanding engineering firms of the older world for the manufacture of machinery which is protected by patents. One of the best examples of this branch of the work is the production of Parsons marine turbines for the Far Eastern territories.

It is not proposed in this article to deal in a general way with the shipbuilding and marine engineering features, but to emphasise more particularly the very large way in which electric power has been utilised in the operation of these works. It is almost a foregone conclusion that the equipment of a new works involves the utilisation of electric power, as in these days electricity is recognised as one of the most valuable adjuncts to marine engineering operations. We have, however, in the Mitsu Bishi Dockyard and Engine Works at Nagasaki, a very interesting object lesson on the quickness of the Japanese to adapt themselves to most modern ideas. The Nagasaki works are not of mushroom growth. They have been in existence since 1856, and therefore it would not be wondered at if the owners of these works had adhered to older forms of power, when it is remembered that even in this country there is a considerable amount of conservatism in this respect. Electric power has, however, been adopted on a most remarkable scale, the advantages of a centralised power plant having been realised in the very fullest sense.

Fig. 1 illustrates the central power house which is situated at the Akunoura engine works, and which supplies electric current to over 200 motors, having a total brake-horse-power of 4,303. These motors are utilised to drive the machines in the various departments and in addition to this, electric lighting is installed to the extent of about 3,000 incandescent lamps and 200 arc lamps on the whole premises. The generators are of two types, there being both a low-tension direct-current system, and a high-tension alternating-current distribution. The generators for the low-tension network comprise one 500-KW. direct-current generator, two 100-KW. direct-current dynamos, and two 225-KW. direct-current dynamos, generating together 1,150 KW. Besides this 1,542 H.P. of plant, there is a 300-KW. direct-current dynamo coupled to a three-phase induction motor, this unit providing a link between the high

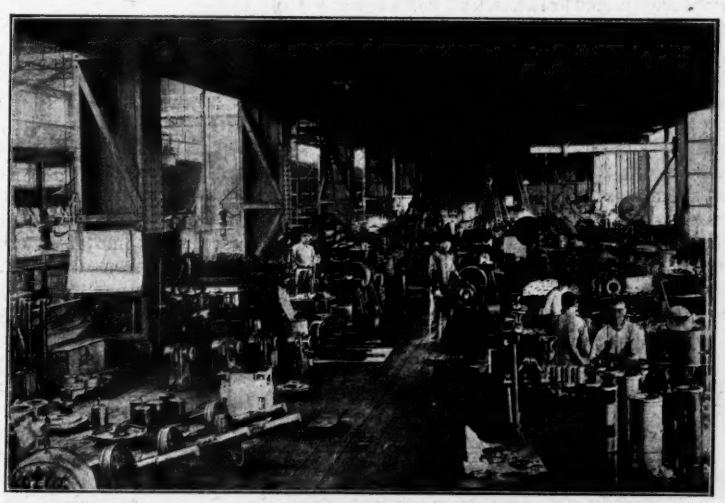


Fig. 2.—Electrical Shop, Mitsu Bishi Works, Japan.

and low-tension distribution systems. On the high-tension alternating current system the generators consist of two Parsons patent 500-KW. turbo-alternators direct-coupled to turbines of the Parsons type. These generators operate at 3,450 volts, and are used for the supply of current to a sub-station erected at Tategami, and to electric pumps operated on the No. 1 dock of the firm. It is interesting to note that while one of these generating sets was manufactured by Messrs. Parsons & Co., of Newcastle-on-Tyne, the other set was manufactured by the Mitsu Bishi Dockyard and Engine Works under licence from Messrs. Parsons.

Besides the above plant a central power house contains two direct-current dynamos each of 25-KW. capacity for the purpose of meeting the requirements of vessels in dock, the aggregate generating capacity of the power house being 2,200 KW., or approximately 3,000 H.P. It may be added that there is a set of Tudor storage batteries numbering 132 cells, with a capacity of 3,000 ampere-hours. Steam constitutes the motive power of these generators and dynamos, and is supplied by two Mitsu Bishi Nesdrum boilers and seven Babcock & Wilcox boilers.

Reference was made above to the high-tension transmission effected to the Tategami sub-station. This sub-station is situated in the Tategami shipyard for the supply of current in that direction, the outfits consisting of two 200-KW. rotary converters which convert the 3,450-volt alternating-current from the central power house for supply to a 250-volt direct-current distribution. Without attempting to specify categorically the power plant which is driven by the high and low-tension systems, it may briefly be stated that both as regards the engineering department, platers' and fitters' sections and other engineering sections of the works, and the shipyard itself together with the berths, these are fully equipped electrically both for power and lighting, and the developments displayed in this have fully equalled the most advanced methods of application practised in our home dockyards. Special reference, however, may be made to the electric shop, which is attached to the engineering section, and which is illustrated in fig. 2. Part of the three-storeyed bay of the erecting shop is allotted to this electric shop, which is fitted with a 3-ton automatically-driven electric lift, a 3-ton overhead truck, a 5-ton electric crane, and all the necessary appliances for the manufacture of and repairs to Parsons turbo-alternators, together with the construction of generators and motors of every description for use in steamships. A considerable amount of work is also carried on in general electrical machines and tools, and, of course, the maintenance of electrical outfit of the works themselves is carried on in this department.

From the above notes it will be apparent that, very far from lagging behind western ideas with regard to the application of electricity to marine engineering, there is, in every probability, more than one aspect of the matter which should afford food for thought for the engineering staffs of British marine engineering works, and for this reason we are much indebted to the general manager of the Mitsu Bishi Dockyard and Engine Works for his courtesy in providing us with the above information.

ELECTRICAL SCHEME FOR MELBOURNE: AN IMPORTANT PROPOSAL.

[FROM AN AUSTRALIAN CORRESPONDENT.]

PEOPLE in Great Britain who know of Melbourne only by repute, and think of it as a great city, would be astonished at its electrical backwardness, if they could be suddenly transported here on some magic carpet of Arabian design, or a long-distance aeroplane of Western European manufacture. It is hardly too much to describe it as many years behind Sydney in the applications of electrical power. The most obvious manifestation of its backwardness is afforded by its antiquated cable tram service. Every other Australian capital—Sydney, Brisbane, Adelaide, Perth, Hobart—has an excellent electrical system; and all of them, with the exception of that of Adelaide, have been in operation for a considerable number of years; while even provincial centres—such as Ballarat, Bendigo, Launceston, Fremantle, Kalgoorlie, and Leonora have their electrical services. In one or two of the Melbourne suburbs the municipalities have inaugurated systems of their own, but the city itself, the inner circle of suburbs, and the connection between these, are dependent upon an altogether effete cable service, slow, expensive, ill-lighted, and subject to breakdowns. This is not likely to be superseded for some four or five years, as the company's concession yet has that period to run; but there is a chance that its hands may be forced, or that it may be bought out before the expiry of its term. The probability of this happening is increased by the fact that there is urgent need, not only for the electrification of the tramway system, but also for the electrification of the suburban railway lines, which are run by the Government, and on which the congestion of traffic during the busy hours of the day is becoming more and more a serious problem, and one that is crying aloud to be dealt with without delay.

Melbourne is thus ready for a vast electrical scheme, and such a scheme is now forthcoming. The sponsors are the Victorian Mineral Development Co., and a number of English electrical firms, and it is understood that an expenditure of between two and three million sterling is contemplated. It is proposed to use for the generation of electricity certain brown coal deposits in the neighbourhood of Morwell, a small country town some 80 miles east of Melbourne, the proposal being to transmit the current along two double-circuit lines, each independent of the other, the voltage decided upon being 110,000. The lines are to be borne on towers 70 ft. high, and standing 250 ft. apart, the sag bringing the lines between the towers to within 20 ft. of the ground. Each circuit will be worked upon insulating swivels, and special care will be taken to avoid damage by lightning. The turbine generating plant at Morwell will, if the scheme be carried out, be the largest in Australia, having a capacity of 15,000 KW. From a central station at Oakleigh, 10 miles from Melbourne, the current will be transmitted to sub-stations throughout the whole of the metropolitan area.

The scheme is the outcome of a visit paid to Melbourne and Morwell last year by a trio of German experts, Messrs. Karplus, Turk and Hoffmann. One of these, Mr. Hoffmann, is a leading authority on brown coals, and his services were loaned by the Prussian Government; another, Mr. Karplus, is an electrical expert in the employ of Messrs. Siemens Bros.; and the third, Mr. Turk, accompanied them to do the necessary computing. Although the three experts naturally maintained strict silence when here, it is known that they were greatly impressed with the possibilities of the Morwell coal.

The field has been known and held for very many years without ore being exported with any adequacy. If the evidence of bores may be trusted, there is a vast tonnage of brown coal lying beneath a heavy ore burden, capable of removal by a high degree of hydraulic power to be derived from a neighbouring creek, so as to make the deposit workable by ordinary quarrying methods. There are said also to be very large deposits of lime in the district, and as these assay 95 per cent. of pure lime, there is a probability of the establishment or works for the manufacture of carbide of calcium and various coal products; and it is believed that, owing to the cheapness with which power could be obtained in Morwell, that town would become a great manufacturing centre, and it is expected, too, that a great impetus would be given to Melbourne as a manufacturing city. It is in the cheapness with which, it is reckoned, the brown coal can be won from the ground and put into the furnaces, that this great scheme has its chance of success. The coal is very low in heating power when compared with the excellent black coals of New South Wales; but the exhaustive trials made in Germany of shipments of the Morwell coal show that it gives a heat far in excess of that produced by the best German brown coals, which have been found exceedingly valuable for such purposes as that for which it is proposed to utilise the Victorian deposit.

To turn this deposit to a marketable use would in itself be a great gain to the State. When tested by the State Mines

Department many years ago, it was found by a diamond bore to be more than 800 ft. in thickness, and was declared to be the biggest known coal seam in the world. But an exhaustive trial showed it to be of very little use for railway purposes in its natural state. Briquetting was then resorted to, and great anticipations were indulged in, but these were all falsified by the event. However, some briquettes made from the coal in Germany were pronounced to be 20 per cent. above the average made in that country and Austria from local brown coals. The failure in the Victorian experiments was in not raising the temperature to a degree sufficient to cause the agglutinative elements to liquefy to such an extent as to enable them to adhere. The three experts already mentioned are understood to be of opinion that, when properly briquetted, as in Germany, the Morwell coal will prove thoroughly satisfactory. If, as was asserted by the Victorian Coal Commission, its heating properties in such circumstances are only 10 per cent. below those of average New South Wales black coals, the fact that it is little more than 50 per cent. of the price of such coals is a matter of very great importance. It is worthy of mention that it will produce gas up to only about half the power of Newcastle (N.S.W.) coal, while its tar and ammonia percentages are very low.

a low intensity, and previously calibrated against standard incandescent lamps. This mercury-vapour sub-standard was

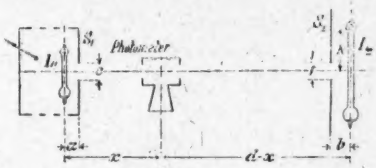


FIG. 2.

of the Cooper-Hewitt type, as shown in fig. 1, and had a length L = 10 cm., inner diameter *dri* = 23 mm. The normal current (*i.e.*, current at the minimum voltage point) for this lamp was about 3½ amperes, but the lamp was worked at only 2½ amperes for the tests.

Such a lamp, after burning for about 100 hours at normal current to effect the initial blackening of the glass, which always occurs, and if kept at a constant room temperature and run at a reduced current, forms a very satisfactory and steady standard. This particular lamp only fell off about 1½ per cent. after being used for 300 hours. It gave 2·95 hefners per cm. length. This standard L_1 was enclosed in a perforated box, as shown at S_1, fig. 2, having a vertical opening C (which could be varied in length between 10 mm. and 50 mm.) facing the photometer. At the other end of the 230-cm. photometer bench the lamp under test (L_2) was fixed behind a large screen S_2 with an opening *f*.

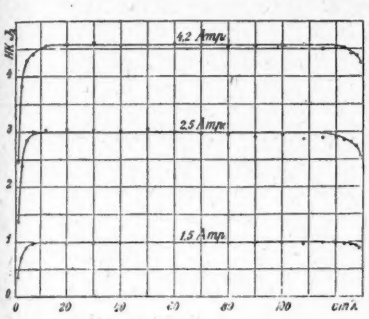


FIG. 3.

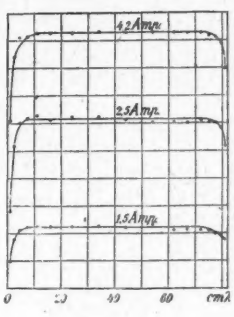


FIG. 4.

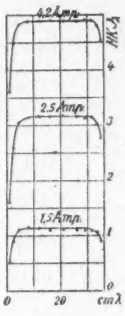


FIG. 5.

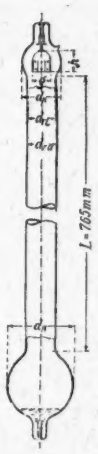


FIG. 6.

A PHOTOMETRIC INVESTIGATION OF MERCURY-VAPOUR LAMPS.*

THE points dealt with in this investigation are :—(1) The distribution of light intensity along the length of a tubular mercury-vapour lamp ;

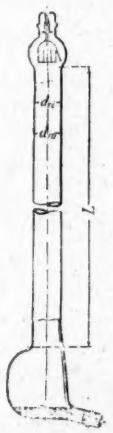


FIG. 1.

(2) The effect of the tube diameter on the light intensity and efficiency, and

(3) The comparison of the behaviour of such a lamp on direct and alternating currents.

The photometric measurements were made with a Bunsen photometer against a short mercury-vapour lamp worked at

The lamp was supplied with direct currents of 1·5, 2·5 and 4·2 amperes, and, after burning it for two hours to ensure a steady condition, a set of photometer readings was made with the lamp shifted step by step so as to bring all points of the lamp from the positive up to the negative electrode, opposite the photometer opening. The results are given in fig. 3.

The lamp was then cut down to 82 cm. clear length of arc L, and the tests were repeated, with the results shown in fig. 4.

Finally, the length of arc was reduced to 36 cm., and the readings shown in fig. 5 were obtained.

These tests show that whilst the C.P. is constant for at least the central third of the length of the lamp, it falls off somewhat at each end. The ratio—

$$\frac{\text{Average C.P. per cm. of whole lamp}}{\text{C.P. per cm. of central third}},$$

works out with considerable constancy to ·98.

For the second series of tests, to determine the effect of the tube diameter, a set of six similar lamps was made up as in fig. 6, all 76·5 cm. long, and having the following dimensions :—

*Abstract of an article by Dr. J. Pole, *E.T.Z.*, February 15th, 1912.

Internal diameter (dri) = 8·6, 15·6, 25, 35, 45·8 and 61·5 mm.
External diameter (dra) = 9·9, 17·6, 27·1, 37·5, 47·6, and 66 mm.
Diameter of positive bulb (dp) = 19·2, 25·4, 34·4, 48, 61·6, and 80·8 mm.
Diameter of negative bulb (dn) = 22·5, 40·5, 63·4, 89, 116, and 152·5 mm.
Diameter of positive electrode (g) = 9, 13, 17, 24, 31, and 38 mm.
Height of positive electrode (h) = 11, 14, 19, 25, 24, and 35 mm.

The positive electrodes were of iron, and the bulbs were spherical and not blackened. The above dimensions were carefully chosen, so that at normal current the lamps were all working with about the same electrode current density, and under the same internal temperature conditions.

Photometer readings were taken for the central point of each lamp with various currents, starting from the lowest current, which could be kept constant with the aid of considerable self-induction in the circuit, and going up to the current at which the + electrode just began to glow, and beyond which the lamp could not be worked satisfactorily.

The results obtained are given in figs. 7 and 8, curve IV referring to the tube of smallest diameter, and curve IX to that of largest diameter.

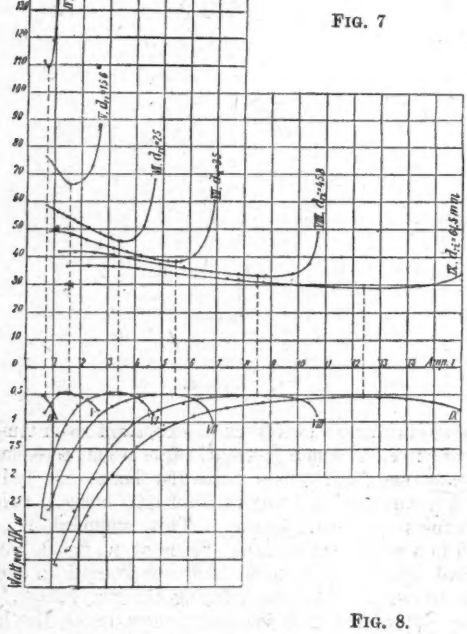


Fig. 7

Fig. 8.

Fig. 7 gives the connection between lamp current (i) and lamp voltage (e), and fig. 8 that between current (i) and the watts per average C.P., and per cm. length of lamp $= W = \dfrac{e \times i}{\cdot 98 \times L \times J}$,

where L = length of lamp in cm.
J = hefners per cm. of length of lamp at central part of lamp.

It will be seen that the minimum consumption in each case occurs at the "normal" current (*i.e.*, at that current for which the terminal voltage is a minimum) and has the almost constant value of ·5 watt per hefner, neglecting the losses in the regulating resistances.

Finally, for the purpose of comparing alternating-current and direct-current lamps a special lamp was made as shown in fig. 9. It was provided with two iron positive electrodes a_1 a_2, a main negative mercury electrode C, and an auxiliary anode a_3 for maintaining the arc. The lamp was arranged for connection either to an A.C. supply from an auto-transformer (T) or to a D.C. supply, by throwing over the switch S to position II or position I (fig. 10).

In order to maintain the ionisation of the cathode C at the instants of zero current a constant direct current of 1 ampere was kept flowing from the auxiliary anode C to the cathode C through the resistance R_3, as shown.

The A.C. supply voltage was regulated by means of an auxiliary adjustable transformer, and the D.C. voltage by the regulating resistance R_2. The divided small resistance R_1 was inserted merely to ensure the equal loading of the two anodes a_1 a_2 on D.C. The degree of pulsation of the rectified alternating current through the lamp could be varied by introducing more or less of the inductance L_1 L_2.

In the absence of suitable apparatus for taking up the curve shape of the supply current, Dr. Pole used three ammeters to determine the nature of the current: M_1 was an

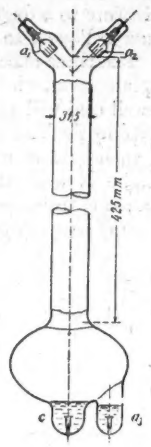


Fig. 9.

ordinary moving-coil Weston instrument reading the average value i_1 of the pulsating current through the lamp; M_2 was a hot-wire ammeter reading the R.M.S. value i_2 of the whole current; and M_3 was an induction ammeter reading only the effective value i_3 of the alternating part of the current. For a pure sine wave of current $i_3^2 = i_2^2 - i_1^2$.

The tests were made by switching on the lowest value of direct current i_1, and keeping this on until a steady state was reached, and then taking a photometer reading at the centre of the lamp. S was then switched over on to the A.C. supply with the greatest amount of inductance in circuit (*i.e.*, smallest pulsations of current), and the A.C. supply voltage was regulated until exactly the same reading i_1 was obtained on the Weston meter, M_1, as before on the D.C. test. When a steady state was again reached, the photometer reading was repeated. The inductance in the circuit was then reduced somewhat by short-circuiting L_1, and the current i_1 was again regulated to the same value, and another photometer reading was taken. Finally L_2 was also cut out and another photometer reading taken. The lamp was then

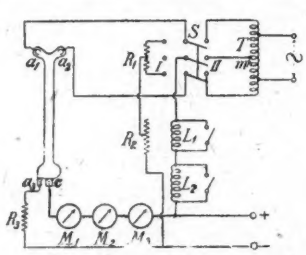


Fig. 10

once more switched on to D.C. and the whole test repeated with a higher value of i_1.

In this way readings were obtained between $i_1 = \cdot 3$ amperes and $i_1 = 5$ amperes, and all the tests show with remarkable unanimity that for a given direct-current reading i_1 the candle-power is exactly the same, whether used on direct current or on alternating current.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend of 1¾ per cent. for the three months to March 31st, being at the rate of 7 per cent. per annum on the common stock. A half-yearly dividend of 3½ per cent. for the six months to March 31st (7 per cent. per annum) has also been declared on the preference stock.

PROCEEDINGS OF INSTITUTIONS.

High-Voltage Tests and Energy Losses in Insulating Materials.

By E. H. Rayner, M.A., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, February 8th*, 1912.)

The present paper describes experiments which have been made during the last three years on some insulating materials which are commonly used in electrical apparatus working at a high voltage. The work has been carried out at the request of the Engineering Standards Committee. The point on which information was specially requested was whether damage to insulation of electrical plant was more likely to be caused by a short application of a high test voltage, or by a longer application of a lower voltage.

A research of this nature labours under the great disadvantage that the results depend very largely on such physical conditions as temperature and humidity. These important external influences, and, very commonly, the great variation of a large number of successive similar experiments from their mean, often largely mask the effect looked for.

For the purpose of this research the Engineering Standards Committee presented to the laboratory the necessary generating plant. This consists of a 20-kw., 200-volt, 40 to 60 cycle motor-alternator with field resistances, a transformer of 100,000 volts, and a subsidiary auto-transformer, constructed by the British Westinghouse Co. For the accurate measurement of high voltages the Laboratory has added an electromagnetic precision voltmeter of 500 volts, together with resistances amounting in all to 99·5 times that of the instrument. By this means 100,000 volts can be measured. The voltmeter and its resistances were made by Hartmann & Braun, while the switchgear and the mounting for the whole apparatus were made at the Laboratory. A large electrically heated oven has been constructed for doing experiments at any temperature up to 200° C.

For the experiments described in the latter portion of the paper a high-voltage electrostatic watt-meter with the necessary resistances and switches was constructed. This has been used for power measurements up to about 15,000 volts. Unless otherwise stated, a frequency of 50 cycles per second has been used. Temperatures are in °C.

For the application of the voltage to oiled fabrics, &c., brass electrodes were used, with well-rounded edges (fig. 1, No. 1). These were replaced later by others of sharper curvature at the edge, as it was found that the increased voltage stress was more than compensated by the weakness caused by the heating due to increased

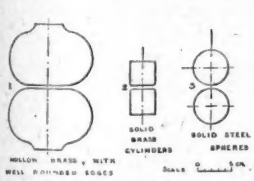


Fig. 1.—Electrodes.

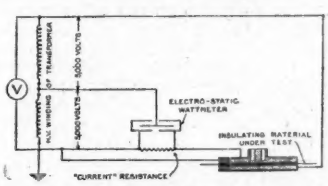


Fig. 2.—Wattmeter Test using Guard-Ring.

brush discharge when edges of large radius of curvature were used (No. 2). The effective surface of these electrodes was a circle of 38 mm. (1·5 in.) diameter, the edge being rounded to a radius of about 3 mm. (⅛ in.). For the experiments on mica, steel spheres 5 cm. (2 in.) in diameter were employed (No. 3).

One of the first tests on the materials was to find how electric stress at breakdown varies with the number of sheets used. These materials are always used in several layers in high-voltage machinery, and these experiments gave information as to the number of layers which might be considered most suitable for further testing of the material.

Table A gives the results of a series of tests of breakdown using from one to ten layers of thin oiled paper.

The voltage was in each case raised to the value given in Table A, so that breakdown occurred in about 20 to 40 seconds. It will be noted that when several thicknesses are tested the voltage per sheet falls as the number of sheets is increased. When only two

TABLE A.—Thin Oiled Paper, 0·095 mm.

Sheets.	*Voltage per sheet.*	*Sheets.*	*Voltage per sheet.*
1	1,080	5	1,920
2	1,995	7	1,770
3	2,300	8	1,800
4	2,210	10	1,770

or three layers are tested the voltage per sheet rises. This is due to the thinness of the sheets, as the weakest parts of a sheet are generally much weaker than the average when the sheets are of so thin a material as this. On putting two or three thicknesses together, the weak spots in one sheet are generally covered by stronger parts of the others.

The results on somewhat thicker oiled materials show a fall in voltage per layer when more than two layers are tested together. For still thicker materials the voltage per layer falls from the first owing to the decreased proportional effect of small local variations in the thickness and quality of the material, and to the less efficient cooling of the metal electrodes (Table C).

TABLE C.

Number of sheets.	Average breakdown voltage per sheet.—Oiled cloth, No. 5, 0·14 mm.	Oiled cloth, No. 7, 0·18 mm.	Red Empire paper, 0·17 mm.
1	3,600	5,780	4,720
2	3,750	4,020	4,110
3	3,250	3,410	3,370

A series of tests was made by subjecting portions of the material (four thicknesses, 0·095 mm.) to 4,000 volts for 5 minutes only, and then determining the breakdown voltage. This was found to average 9,180 volts. Alternate portions of the sheet were tested in a similar way, but without the previous application of the 4,000 volts. The average breakdown voltage was 9,140, showing that the short application does not produce any measurable depreciation.

The same pressure, 4,000 volts, applied for periods of 15, 30 and 60 minutes, produced a lowering of the breakdown voltage by 8, 14 and 11 per cent. respectively—the last result showing the uncertainty of such tests.

A common method of working is to apply a high voltage and to observe how long the material will withstand this before being pierced. The following tests (Table E) show the kind of results obtained:—

TABLE E.

Thin Oiled Paper, 0·095 *mm.* (*Four Thicknesses*). Voltage.	Time elapsing before failure.	*Oiled Cloth, No. 5*, 0·14 *mm.* (*Three Thicknesses*). Voltage.	Time elapsing before failure.
15,000	0·0 seconds	10,000	3·7 seconds
12,500	0·5 ,,	9,000	10·3 ,,
11,000	1·2 ,,	8,000	14·6 ,,
10,000	4·6 ,,	7,000	78·0 ,,
9,000	14·0 ,,	6,500	617·0 ,,
8,000	105·0 ,,		

Working on these lines, one method of determining whether a material has suffered by any treatment is to subject it to a voltage which will break it down, and to compare the time required with that required by similar material which has not been subjected to the treatment in question. The breakdown voltage should be such that the time of breakdown does not exceed about a minute.

It was discovered that very small temperature alterations would make considerable differences in the time of breakdown. Variations in the humidity of the atmosphere also had a marked effect (Table H).

TABLE H.

—	Air desiccated with calcium chloride (1 week).	Dry day.	Damp day.	Air saturated with moisture (1 week).
Oiled cloth, No. 5 (three thicknesses) ...	11,160	8,300	7,150	5,850
Oiled cloth, No. 7 (two thicknesses) ...	10,800	9,000	7,550	6,400
Oiled paper (two thicknesses)	9,750	8,200	8,300	7,300

Results obtained from experiments on materials after artificial drying would have to be modified to a very uncertain extent in order to make them applicable to materials in a damper condition. Experiments were, therefore, generally done varying one condition at a time as far as possible, doing control experiments on similar material not subjected to the physical condition in question.

The great effect that temperature will often have on the time of breakdown of highly stressed insulation is shown in the following table of results of tests on oil cloth at three temperatures.

TABLE J.—No. 12, Oiled Cloth (One Thickness).

Volts applied.	Time of breakdown.—Air temperature. 11° C.	Air temperature. 14° C.	Air temperature. 18° C.
7,000	21·0 minutes	8·3 minutes	25·0 seconds
8,000	13·5 seconds	10·0 seconds	8·5 ,,

A long time test may have a very serious effect. After treatment at 5,000 volts for one hour, 7,000 volts caused failure in one-sixtieth of the time required in the case of fresh material.

In all these experiments it was found that breakdown very rarely occurs between the flat surfaces of the electrodes, but generally takes place at a point just outside, where the curvature of the electrodes introduces an air-gap of about a millimetre. The material here is in a weaker state for two reasons: It is not subjected to the cooling of the metal electrodes to the same extent as if it were in intimate contact with them, and there is considerable evolution of heat due to the maintenance of brush discharge in the air when the stress is sufficiently high for its production. The results show how serious is the weakening, due largely to chemical change, which is produced by the brush discharge when long continued.

Electrodes with flat surfaces continued in curves of large radius impose a greater stress on these materials than electrodes with sharper curves, on account of the comparatively large area of insulation subject to the influence of brush discharge, and perfectly square edges might impose still less stress. In fact, material was

found to fail in 17 seconds using electrodes the edges of which had a curvature of 3 mm., while 22 seconds was required when square edges were used.

The effect of metal in contact with highly stressed insulation is materially to retard temperature rise and breakdown by reason of its thermal conductivity and heat capacity. The thermal properties of the electrodes are of less importance when the electric stress is so high that breakdown takes place in a few seconds.

To obtain further information on the relative damage caused by a short application of a high voltage and a long application of a lower voltage, experiments were made in the following manner. If a given insulating material be equally damaged at various voltages by being subjected to a steady application of electric stress till it is about to be punctured, then, just before breakdown, samples subjected to a high voltage for a short time and others to a lower one for a much longer time ought to be equally weakened. If, however, as is usually assumed, a prolonged stress at a lower voltage is more exacting than a short one at a higher voltage, the two specimens at the moment when they are about to puncture would

TABLE Q.—No. 12, Oiled Cloth (One Thickness).

Voltage.	Time of breakdown.	Period of application of voltage.	Further period at 6,500 volts.
7,000	28·6 sec.	14·3 sec.	29·2 min.
6,000	30·3 min.	15·1 min.	9·5 sec.
5,500	81·0 min.	40·5 min.	0·8 sec.
		Fresh material ...	28·8 min.

be differently weakened. As it is impracticable, generally, to stop a test a few moments before breakdown, it is more convenient to take, say, half the time required to pierce the material at any given voltage. After this treatment the specimens which have been subjected to different voltages in this manner may be tested at such a voltage as will give a conveniently discriminating time of breakdown.

In Table Q is given the result of one experiment on these lines. Similar samples were tested at 7,000, 6,000, and 5,500 volts, and were found to fail after 28 seconds, 30 minutes, and 81 minutes. Other specimens were then treated for half the above times at the same voltages. In order to equalise the temperature conditions they were then left for the night and were tested next day at 6,500 volts. The time required to puncture is given in the last column. It will be noted that the portion treated to the highest voltage agrees with the test on fresh material.

This weakening effect is most conspicuous on the surfaces of the material where the air has free play, and where the destruction of the surface glaze by the brush discharge is greatly facilitated. If more than one thickness of material is tested the inner surfaces protect one another to a great extent, and the weakening does not appear to be so pronounced.

The irregularity of results in a research of this nature, and the difficulties caused by sensitiveness to temperature and humidity, increased the desirability of some new instrumental method of studying the nature of electric stress on insulation. From the beginning the importance of some apparatus to measure the energy loss due to alternating stress on these materials had been kept in view. For this purpose a quadrant electrometer was made, and was used in conjunction with an arrangement of guard-ring electrodes (fig. 2).

A few degrees in the atmospheric temperature may make all the difference as to whether insulation will endure for a very long time or will inevitably fail. The wattmeter shows perfectly what the course of the experiment is likely to be.

In an experiment on oiled cloth, the initial watts were 0·028 per sq. cm., and gradually rose to 0·039, becoming very nearly steady at this value. The temperature of the electrode rose from 2·2° to 9·0°, changing only 0·2° in the last 10 minutes, while the air temperature remained between 0° and 1° during the time of the experiment.

In a similar experiment done at an air temperature of about 15° C. the initial watts were about 0·04 per sq. cm., as against 0·028 at about 2° C. The rapid increase of energy loss with temperature was so great that at about 40 minutes there is a point of inflection in the temperature curve, which becomes "explosive" with the concave side uppermost. The wattmeter gives unfailing notice of the impending breakdown of the insulating material, which, in this case, took place 25 minutes later. The exceedingly rapid rise of the watt curve in the last few minutes is especially remarkable, the final value being 20 times the initial, while half the rise takes place in the last half-minute.

Samples of the same material were dried in a desiccator for 22 hours over calcium chloride. They were then tested at 10,000 volts, and the heating effect was found to be reduced to about one-third of what it was in the experiment last described, the test being made at atmospheric temperature. The consequence is that the loss by radiation and convection is sufficient to balance the internal heating, and the material could endure a very long time. These specimens have been run for periods aggregating many hours at intervals over several months with very little alteration.

An experiment was made using two thin mica sheets completely covering each side of the varnished cloth. These sheets were such that they would just stand 10,000 volts alone. By this means it was expected that a much higher temperature would be reached, which experiment showed to be the case. The material was examined when the temperature was about 100° C., and showed little sign of damage; the experiment was stopped on the thermometer in the top electrode attaining 120° C., when the cloth was found to be distinctly scorched. The curve of watts rises normally for about half an hour, very rapidly attains a maximum, then drops and varies irregularly about a fairly steady average value. This rapid rise and fall must, I think, be due to the driving out of loosely held water at about 100° C. The temperature curve faithfully reflects these changes.

All these experiments demonstrated the importance of the brush discharge in the air, when stressed above its breakdown point, in promoting temperature rise and serious chemical change, when long continued. A lengthy series of experiments was done to determine the potential gradient at which the consequent energy loss in air commences, and measurements were also made of the power lost as the stress is raised above this critical value; the results were described in the discussion on Mr. Watson's paper.*

In testing both pure mica and thick micanite in air, the material very rarely fails between the electrodes, but at an indefinite distance up to, perhaps, 50 mm. away from the metal in the case of thick micanite, and to about half the distance in the case of thinner mica.

A large amount of work on the testing of micanite has been done at the laboratory, especially on behalf of Government departments, the general results being briefly as follows:—The heating caused by the brush discharge in air, especially when high voltages and thick materials are used, has been found to be very serious. The material rapidly becomes hot and softens around the electrodes, swells by internal vapour pressure, and is finally pierced. It is well known that immersion in oil in general greatly reduces the electric strength of good insulators, the breakdown voltage often being reduced by 50 per cent. In the case of thick micanite, however, this effect is often more than counterbalanced by the almost entire extinction of the brush discharge. In the case of thinner qualities immersion in oil is generally of little or no value. Very much depends on the quality, and the effect of immersion in oil cannot be predicted in the case of ordinary commercial micanite. For instance, while thick boards of ordinary brown commercial micanite, 2·5 mm. thick, generally give better results by being immersed in oil, it has been found that similar thicknesses with the adhesive material largely pressed out give worse results in oil.

Generally speaking, thin qualities up to about 1 mm. will withstand a stress of 20,000 volts per millimetre in air for 10 minutes. Above this thickness, up to 2·5 mm., there is more difficulty in making material which will withstand this stress, and usually the material withstands the voltage longer under oil.

Mica may be run very near the breakdown point for a long time, and is unaffected by ordinary temperatures met with in machines. In making watt tests on mica, it was found that though the material heated, probably almost entirely owing to the brush discharge in the surrounding air, yet the watt loss did not increase with time—a very different result from that obtained when using oiled cloth.

Tests in air on pure mica are limited to comparatively small voltages and thicknesses of material. Sheets of mica are limited in size to 6 or 8 in., and in thicknesses above 0·2 mm. sparking round the edge takes place above about 18,000 volts.

The results of tests are shown in the upper curve in fig. 3. As in the case of micanite, the material very seldom fails where it is in contact with the metal electrodes, but at a distance up to 25 mm. away. In these experiments the electrodes used were two steel balls 50 mm. (2 in.) in diameter.

The lower curve shows the average result of testing under ordinary transformer oil. The results in general show an electric strength about one-half that in air.

A long time of voltage application appears to have a weakening effect, which is probably mostly due to temperature rise. For instance, a sheet of mica 0·040 mm. thick which failed at 10,000, 10,200, and 10,400 volts, when the voltage was raised to these values in about 20 seconds, was subjected to 8,000 volts and failed in 70 seconds. Another place was subjected to 7,000 volts and the material held up for over two hours and was not punctured.

Under oil, mica will stand for a long time a voltage very little below that which will puncture it in a few seconds. Pertinax insulating material is made by rolling thin paper on a mandrel. During the process the paper is covered with hot varnish, and the excess is squeezed out by a heavy roller. This material forms a tough and strong form of insulation suitable for many purposes. It was supplied in the form of tubes of 11 mm. external diameter, the walls being 1·5, 3 and 4 mm. thick. The tubes were 50 cm. long. They were tested by applying the voltage between mercury which filled the hole and a layer of tin foil tightly wound round the middle of the tube for a length of 34·5 cm.

The diagrams have been plotted with watts per square centimetre of outside surface. The heating, as in previous experiments, is entirely due to insulation losses.

Fig. 4 shows the results of experiments at 5,000, 4,000, 3,500 and 3,000 volts on the Pertinax tube of the largest bore. The curve A_1 repeated and continued in A_2 on one-tenth the scale of ordinates shows the effect of the application of 5,000 volts producing failure in 12 minutes. B_1 and B_2 are the results at 4,000 volts, failure resulting in 31 minutes, while C and D are tests of 160 minutes at 3,500 and 3,000 volts.

Near the dividing line, only a slight alteration in the conditions such as a rise of temperature or frequency was required to produce the condition leading to failure. This indicates very clearly the difference between these insulation losses under alternating potentials and losses due to a resistance effect alone. The latter would be independent of the frequency, while most of the tests on these materials which have been made to determine the effect of frequency indicate that, when working under the potential gradients met with in practice, a large proportion of the loss is proportional to the number of cycles of alternating stress in a given time and is therefore of the nature of a hysteresis effect.

* *Journal* of the Institution of Electrical Engineers, vol. 45, p. 5, 1910.

Fig. 5 shows the result of a test on the thickest walled Pertinax tube. The lower curve A represents the course of an experiment at 6,000 volts for 130 minutes, and the upper curve gives the result of a second experiment on the same tube at 7,000 volts. These curves are similar to several previous ones.

The conception of a condenser with series resistance seems to represent the physical condition of ordinary insulating materials. From this point of view a dielectric may be considered to be not a

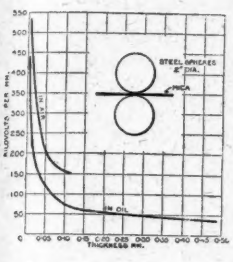


Fig. 3.—Tests on Mica.

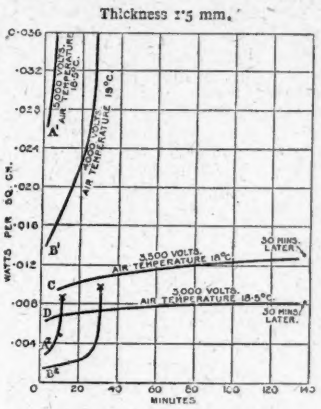


Fig. 4.—Pertinax Tubing.

single condenser with a series resistance, but an immense number of very minute condensers, perhaps of molecular dimensions, each with a series resistance. The whole thickness of the dielectric would be made up of an almost infinite number of such condenser and resistance systems in series. In practice we can but obtain a measure of the single equivalent condenser and resistance. As the insulation is heated the energy loss increases rapidly.

On the theory of a condenser and series resistance, the increase in energy loss as the temperature rises may be due to an increase in the condenser capacity, more than sufficient to compensate for a diminution in the resistance. This would alter the distribution of voltage between the two so that the actual watts are increased.

The measurement of the electrical properties of solutions of salts shows also an increase of capacity and diminution of resistance with rise of temperature, which indicates that, in organic materials, the energy loss is probably largely of an electrolytic nature.

A long series of experiments was made on material supplied by the British Westinghouse Co., similar to the Pertinax tubing. It was in the form of tubes with an external diameter of 23·5 mm., and thickness of wall 1·9 mm.

The upper curves A to G (fig. 6) show the results of a series of experiments at 5,000 volts, an experiment being stopped when the energy developed in the insulation amounted to about 16 watts. It will be noted that there is an apparent progressive weakening after

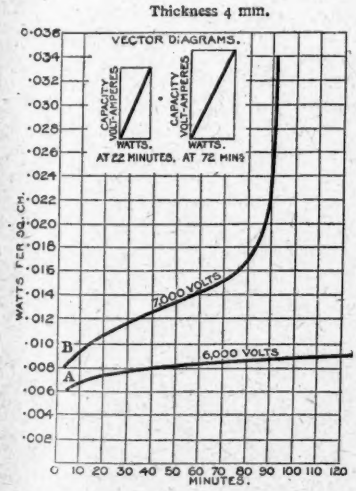


Fig. 5.—Pertinax Tubing.

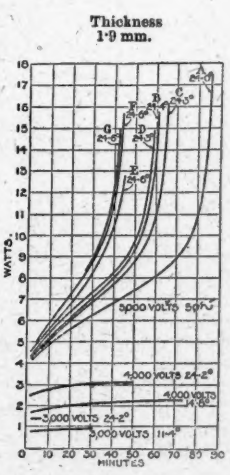


Fig. 6.—Westinghouse Paper Tubing.

each run, the watt curve rising more quickly. Some of the difference is probably the effect of permanent change, but experience shows that it is mostly due to the slightly higher temperature of the later experiments. At the bottom of the same figure are results of two experiments at 4,000 volts and two at 3,000, which give a good idea of the rapid rise of energy loss with voltage.

All the experiments show that if the deteriorating effect of such applications of electric stress as are here described is to be judged by the course of a subsequent application under similar conditions, it is necessary that temperature, voltage and frequency should be the same to a very high degree of accuracy. Under the average conditions of these experiments a change of 1 per cent. in the time of reaching 10 watts would be produced by a change of 4 in 10,000 in the voltage, or a change of 0·02° of temperature, or a change of 0·1 per cent. in frequency. These limits would require special apparatus for their attainment. The margin of the voltage variation is probably impracticable.

The results of tests on one sample of paper-insulated cable are quite similar to those obtained on other organic materials.

Experiments were made on a piece of rubber tubing with an electrolyte inside and out. As the result of a series of tests lasting a fortnight, it was found that a progressive increase in energy loss ensued. At 6,000 volts, 50 cycles, the watts initially were 0·44, and at the end 45. The power factor at the beginning was 7 per cent., and nearly independent of the voltage At the end the watts increased much faster than the square of the voltage, and the power factor was 30 per cent. at 2,000 volts and 95 per cent. at 6,000 volts. Repeated attempts to measure the insulation resistance at 1,000 volts (direct current) showed it to be well above 200 megohms, while at the end the apparent resistance was less than 1 megohm. At the beginning the watts varied nearly as the frequency, while at the end a change in frequency produced practically no change in the watts. This fact pointed to the conclusion that the loss was associated with a true ohmic conductance. The only explanation seemed to be that while under a high electric stress, a great reduction in the ohmic resistance of the rubber took place, and that ordinary tests at a few hundred volts might give no indication of this effect.

This property may be found to have considerable technical importance, and the practice of immersing rubber cables intended for high voltages in water for many hours previous to the ordinary tests may be distinctly undesirable.

Conclusions.—The results of the experiments on oiled fabrics show that when subjected to voltages sufficiently high to break down the surrounding air, a rapid decrease in electric strength is produced, which is largely due to the damage produced by the brush discharge. This action is the more pronounced when a few layers of materal are tested, as the surfaces in contact with the metallic electrodes suffer most. This effect increases with time, and as a comparatively small lowering in voltage corresponds to a great increase in the time required to produce rupture, the effect of a long application is very generally more deleterious than that of a short application of a higher pressure.

An increase in humidity, temperature, or electric stress results in an increase in the rate of heat production, and the temperature may rise till destruction takes place, even if the insulating material be protected by sheets of mica, which are sufficient to withstand the voltage.

The results of the experiments on comparatively thick-walled tubes of varnished paper give time-energy curves of substantially the same form. They indicate that the temperature rise produced by the electrical heating of the insulation produces but little permanent change, provided the rapid final increase is not allowed to take place.

Discussion.

Mr. Miles Walker, in opening the discussion, remarked on the comprehensive results given, which corroborated those obtained by previous experimenters. He assumed that the author's object was to discover whether a short high-voltage test or a long moderate-voltage test was best. So far as theoretical considerations went, a broad view must be taken of what had been done. In order to find exactly the condition of affairs in any material under test, it was necessary to consider jointly the watts lost and watts radiated. The speaker showed diagrammatically that the radiation curve, showing heat dissipated, must overlap the watts lost curve (heat generated) in practice, otherwise the risk of failure was present. The practical test of the manufacturer was intended to break down the material if its insulating properties were impaired but not if it were saturated with damp. A moderate pressure applied for a long time might not show up a weak spot in the damp insulation at all, and a high voltage applied for a short time was much more effective in showing, in such a case, what the manufacturer wanted to know, *i.e.*, defective insulation.

Dr. J. A. Fleming said that, as the result of recent investigations he had carried out, he agreed with the author's conclusions. It would appear impossible to explain the behaviour of many dielectrics without admitting separate conductivities for alternating and direct currents. Alternating conductivity increased with dampness and rising temperature. The conductivity and other properties of insulating material were worthy of most careful study at the present time. He wondered whether the author considered oil or air insulation was best for ordinary transformers. They knew that internal brush discharges were very damaging, and that oil insulation was very useful in preventing them, although air insulation had been recommended by some people.

Mr. A. R. Everest said that experiments made with varnished cloth showed that with very brief applications of from ½ to one-tenth of a second, pressures 20 and 60 per cent. greater than were usual for 15 seconds could be withstood, and these results were confirmed by some given in the paper. In the case of time tests, corona and brush discharge effects had to be considered. Corona effects took place in a large alternator when it was tested for long at rest, and ozone pockets formed, which would not occur if it were running and ventilated. In some cases of this kind artificial ventilation had been provided to avoid this unnatural condition.

Dr. Alex. Russell touched on the question of electric strength of materials, pointing out that under the conditions of the tests on very thin mica sheets there would be considerable electrostatic attraction between the electrodes. The author's tests were of great

value, and appeared to cover similar ground to those of Dr. Fleming.

Mr. G. L. Addenbrooke referred to investigations carried out by himself on the same subject some years ago, and to the varying results on similar material with alternating and direct current, and

Mr. Rayner, in briefly replying, said the high-voltage test for a limited period appeared to be preferable.

Specifications.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, February 13th*, 1912.)

By Fred. S. Sells.

Halsbury's "Laws of England" says:—"A specification is a detailed description of building, engineering, or other works executed, or proposed to be executed." Ball, on "Law Affecting Engineers," says:—"A written description and plans, more or less complete, defining the methods of construction, &c., to be used, prepared by the engineer for the approval of the employer and for the guidance of the contractor."

One of these authorities in law makes a point of saying it is a "detailed" description, the other admits that it is "more or less" complete, and rather a guide than definite instructions.

If there is already such a vital difference in the interpretation of the word "specification," can we wonder that the opinions as to how a specification should be drawn up in practice are equally conflicting? In many cases the want of clearness in specifications is the first bone of contention. Clearness, however, does not necessitate elaboration of detail. I hold it to be advantageous to both sides, if only such details are inserted as refer to the requirements of the purchaser.

A specification must, of course, include all the following points: Quantities; performance (with very clear indications as to rating); capacity; emergency requirements; conditions and regulations to be observed to comply with local or other authorities, such as fire insurance, Home Office, &c.; time of completion and penalties as far as they are not covered by the "general conditions," guarantees, maintenance, tests, and conditions of same; extras. There will be a number of other points covered by the "general conditions" which are customarily expressed in a separate document.

As regards construction and manufacturing details, however, it seems much better, with a few exceptions, if the specification allows as much latitude as possible. The tenderer should be asked to give information upon specific details of construction and design which may be of interest, as is already done regarding steam consumptions, combined efficiencies, air-gaps, &c. At the same time, the tenderer should be invited to give his reasons for adopting certain practices, to state where, if at all, he had adopted it before, and to supply such photographs or drawings as make it quite clear what is in his mind. A number of engineers have already adopted the practice of making their specifications open in some respects, and, if this were done all round, it would help the engineer, as well as the manufacturer.

To my mind the accepted commercial meaning of the word "specification" is the written, printed, or "understood" construction of an article, piece of plant, or works, or the enumeration of the detailed requirements for the execution of a certain performance.

In Germany, France and America, a specification, as a rule, is identical with standard practice. The want of standards, the want of recognised and acknowledged authorities, is a great drawback under which we suffer.

The oldest and plainest form of "specification" is that agreed upon or arrived at by practice and experience of an ordinary article, and commonly accepted as a standard. Unfortunately, in this country we have very few of such standards. Where "Standards" have been set up during the last few years they have not been accepted unquestioningly by the profession, and therefore the manufacturers had to be cautious in adopting them.

The next grade of specification is that drawn up by a professional man for the special purpose of obtaining tenders. Such a specification should contain a detailed enumeration of articles required, stating where and how they are to be fixed. It seems to me, however, out of order that goods should be called for in a specification under a nomenclature which does not denote a specific manufacture or construction, but is a mere indication that a certain dealer supplies them, that dealer having the option of changing the manufacturer at any time so long as he continues to apply his own trade name. Many such instances are happening through the specifier not always knowing who is a manufacturer and who is a factor only.

We know it is the endeavour of consulting engineers to advise their clients to have the most up-to-date, the most economic, and the best-manufactured plant. We also, to our regret, know from our daily experience, that the number of interpretations of these desiderata is almost equal to the number of consulting engineers in practice. Why? Because of the absence of standards, and perhaps because of the absence of some uniformity of education and experience. The trouble may also be partly due to the aloofness of the average consultant from the workshops of the manufacturer. I feel certain that a closer and more regular intercourse between the manufacturer and consultant would result in benefit to both purchaser and contractor. The majority of manufacturers now gladly throw open their works to consultants at all times, and not merely for hurried visits to their test rooms.

When we consider that even to-day, we have hardly any recognised standards in the most simple apparatus required for the carrying out of our work, I think we must all admit that we are far worse off than other countries, and that our consulting engineers are confronted with considerably greater difficulties than any other professional men.

It is gratifying that our various institutions are strengthening themselves by broadening the basis of their operations, and we can only hope that, as time goes on, their work will be sufficiently recognised and supported by the industry and the profession to enable them to establish standards on a larger scale.

So far, nearly every specification a manufacturer or contractor receives is different from anything else he has had before, and whilst this may have been necessary in the early days, it seems hardly necessary to-day.

As technical knowledge and experience has developed during the last 25 years, so has the standard of commercial honour and integrity, and I do not think it either right or necessary that specifications should contain anything which was originally meant to prevent dishonesty. I am glad to say that a large number of leading consulting engineers have already adopted larger-minded methods, but it has, as yet, by no means become general practice.

To-day the weak and incompetent have been weeded out, and there are two kinds of manufacturers left in the running: One, the large firms, who employ the best designers, constructors and engineers whom money can procure, and, apart from their knowledge, the firms are nearly all companies where each employé knows that only good work will hold profit and credit to his concern. The personal element in such organisations is sufficiently strong to combat any attempt at shoddy or incorrect workmanship.

The other kind of manufacturers are the smaller concerns who have specialised in their particular sphere, and they could not have survived if they had not brought brain, character, and the best machinery and tools into their respective spheres, and to them applies the same as I have just said about the large organisations as a whole.

Would it not be a far happier state of affairs if the consulting engineers, instead of drawing up specifications, each of which is a masterpiece of originality, were to adopt standards where standards are in existence; to accept standard practice where standard practice is established; and to ask the manufacturers in their specifications to put forward their own suggestions? Their work would then consist of going through all the various manufacturers' recommendations and suggestions, to decide which is the best-designed and most serviceable plant, and then arrive at a decision which is the best for his client to have, taking into account at the same time the various prices.

This is already done by some, unfortunately too few, and it is a good many years since one of our leading consultants, Sir Alexander B. Kennedy voted himself an adherent to this policy. If it were to become general practice it would encourage manufacturers to establish, where patents, &c., allow it, more standards amongst themselves, and the natural results would be that instead of every article, or every machine, that goes through a shop being different, they would be more alike; manufacturers could produce in larger quantities, which in itself would be a guarantee of better work, deliveries would be quicker, and the cost of production would be reduced, to the ultimate benefit of the consumer.

As regards municipal and supply company engineers, the circumstances are in many cases the same as with consulting engineers. The great difference lies in the fact that this class of engineer has more frequently to be prepared for the acceptance of the lowest tender, without having the same opportunity as the consulting engineer to explain the difference in the offers, and as long as municipalities are governed as they are at present, their engineers will, as far as "detail" is concerned, not be able to alter the present practice in this respect. In his case it must also be remembered that he is even more a specialist in his particular work than the independent consultant, and that in many cases he has more experience of what is actually required than the manufacturer.

There seems to be a fashion in electrical engineering as in most other things, and we find that if one station engineer adopts a new scheme, the principle will in quick succession be adopted by others; nevertheless, the variety of opinions expressed in the specifications is sometimes astounding, and brings for the manufacturing side of our industry unnecessary trouble and expense. Another reason why the municipal engineer must go into more details in his specifications is the fact that he is governed by standing orders, and the specification and tender ultimately form part of the sealed contract.

Another important point which refers chiefly to central station work is the question of cross-tendering between manufacturers of the steam and electrical side, and it has often been suggested that it would be far better if the specifications for combined plant were to be issued separately to the turbine or engine builders, and to the electrical engineers. It is not suggested that two contracts should be given out, but that two separate prices should be received, and that the engineer should choose his own combination. Quite recently a move has been made in this direction by a number of leading manufacturers of engines and generators, and it is hoped that the principle adopted by them will be appreciated and supported by the purchasing and specifying engineers.

Another kind of specification with which the municipal engineer is frequently called upon to deal is with regard to installations connected to his mains. Once regulations of this kind are issued, they should be strictly enforced; otherwise, instead of being a boon, they become a menance and a danger to the trade.

Quite a number of corporations specify that only pure Para rubber must be used in their flexibles, and I should like any member of this Institution, whether engaged in the rubber trade or not, to

come forward and say that he can in every case decide, after the material has gone through certain mechanical processes, whether the rubber is pure Para or not. I have quite recently obtained a delivery of pure Para strip from a leading manufacturer in this country. I submitted it to a leading manufacturer of undoubted repute abroad; and now I have in my possession both a signed guarantee from the supplier that the material is pure Para rubber, and a signed statement from the other manufacturer that it is not.

If we, who handle thousands of pounds' worth of such material, and the manufacturers who make it, have such difficulty in discriminating as to what is pure Para and what is not, how can it be expected that others outside the trade can do so?

It happens very frequently that articles which have once been passed, because they have a certain identification mark, continue to be passed, although in the meantime the supplier (who need not be a manufacturer, and very often is not) has changed his source of supply. Whilst the article has the same trade-mark as it had previously, on close inspection it will be found that it does not comply with the corporation requirements, but has, nevertheless, been allowed to go on the circuits for years.

The contract should clearly state whether penalties, or rather liquidated damages, are to be paid in case of non-completion to time on the whole amount of the contract, or only on the non-completed part, particularly in cases where the non-completion does not prevent the purchaser from the useful enjoyment of the other part.

The Arbitration Clause should be most explicit, and it is, in my opinion, undesirable that under engineering contracts the engineer acting for the employer should be the sole arbitrator. The Arbitration Act of 1889 should be good enough for anybody.

The contract form should be most explicit regarding the much-disputed item of extras, especially in those contracts where the engineer has power to vary his requirements during the execution of the work. It should also provide a clause as regards any consequences which might arise from the introduction of variation in the work originally called for in the specification.

In those specifications where payment can only be obtained under certificate of the engineer, the contract form should specifically stipulate that these certificates cannot be reasonably withheld, and where the time of the last payment is determined by the completion of the successful tests on site, or by the time the purchaser has started to work the plant, the contract form should specifically mention that the purchaser has no right to delay the test or the putting to useful work of the plant. It should furthermore provide a definite time for payment in those cases where delays occur through no fault of either of the contracting parties. I suggest the general adoption of the following clause which appeared in the specifications issued by Mr. C. H. Wordingham when he was in consulting practice:—"The engineer undertakes that he will consider all drawings submitted by proposing contractors as confidential, and that he will not show any such drawings to other manufacturers, whether they are tendering for this specification or not."

Discussion.

Mr. T. L. Miller thought the paper was really a plea for the adoption of standards of manufactures by manufacturers, but it must not be forgotten that electrical engineering was a progressive science, and what might be standard to-day, became out of date next year. The British Engineering Standards Committee had avoided, as far as possible, the standardisation of manufactures. It was impossible to impose one standard on all manufacturers throughout the country, and to do so would stop progress entirely. It had been his practice for a good many years to state in the specification that contractors should state the standards which they had adopted in their own practice. So long as those standards would give the specified results, that was all that was required; to attempt to specify more closely would only add expense. He agreed with Mr. Sells that consulting engineers, and all engineers who were required to specify for machines, should keep in close touch with the works. He considered that a consulting engineer's duty was not only to see that the client got full value for his money, but also that the contractor was fairly dealt with. His own method had been to ask for a very considerable number of details of the plant by means of schedules to be filled up by the manufacturers. With the schedules and details before him, it was possible to adjudicate on the tenders received, and it could then be left very largely to the manufacturers to specify their own standard practice. He agreed that an engineer should not be the sole arbitrator of his own specification, as it was very unsatisfactory.

Mr. S. L. Pearce said with regard to the Standards Committee, there was still an enormous amount of work to be done. To take only two instances, he might refer to the question of standardisation of overload ratings; at the present time the position seemed to be pretty well chaotic up and down the country, especially since the introduction of turbo-alternating machinery. Then they had the other question of measuring temperature rises. On these questions alone something could be done to standardise details of very great importance to electrical manufacturers. Street lighting was rather a burning question at the present time, and he was not without hope that before long something in the nature of a standard specification might be evolved as the result of the joint deliberation of all parties interested. They ought to bear in mind that there was a great deal of difference between a specification drafted by a civil engineer and a specification drafted by an electrical or mechanical engineer. It was well known that the civil engineer was responsible not only for the general scheme, but also down to the very smallest details; the contractor was only responsible for the actual construction. That was not the case with an electrical or mechanical engineer; he did not design the plant or the details of the machinery—this should be left to the manufacturers. With regard to the type of specification, the one which he thought would ultimately (having regard to the question of standards being adopted) be finally adopted was that in which the engineer would protect himself and specify the main outlines of the work which had to be carried out; he would in greatest detail specify the performance of the plant, and would call from the contractor for the most important details such as the question of overload capacities and temperature rises, and so forth; and the contractor would have to submit with his tender a detailed specification of his standard practice, accompanied with descriptive matter and with complete plans. If that were done the manufacturer would be enabled to supply standards, or at any rate, standard parts, where his ordinary standards would be subject to modifications due to local conditions. The specification which was simply drafted in terms of results alone was undoubtedly vague, and would lead to a great deal of trouble in interpretation. He did not see how one should do as the author seemed to suggest, viz., set up one standard for an engineer who was not working for a municipality, and another for the municipal engineer. Cross tendering was a matter which must be left to the manufacturers themselves. What municipal engineers wanted was to have one man responsible, and it was not for them to dovetail together the various parts of a main contract between the various manufacturers. He gathered from Mr. Sells that he did not believe an engineer should specify any particular make of plant. He disagreed from that entirely. Where an engineer had studied his own conditions, and came to the conclusion that one particular type of plant would best meet his requirements, he was quite right to specify that type of plant.

Mr. Bevis said that unfortunately, in a very large number of instances when standards were arrived at, they were ignored by the majority of people concerned. What was wanted was not so much standards, as a standard authority. He was quite sure that if they had a standard authority that was recognised throughout the whole country, they would attain better results, and manufacturers would be able to work more cheaply, and at the same time give better value for the money. A few years ago Para rubber was the standard of high-quality rubber. To-day that standard was not quite up to the plantation rubber, which was a product of the original Para. It was only the cleverest experts in the rubber trade that could tell the difference. To get everybody on the same level, pure rubber should be called for and not "Para." If the best quality rubber was wanted, then "cut sheet" should be specified. Where a specification was clear and well drawn up, and stated explicitly the results required, it was astonishing how close the tenders were for that work.

Mr. A. B. Anderson said a specification must be just, explicit, and must make reasonable allowance for that commercial rectitude to which Mr. Sells properly referred. To get the best work was the object of any specification. They must allow for and cultivate good faith, without which neither the electrical nor any other industry would prosper.

Mr. G. Layton said that something should be done immediately to get specifications into a simple standard form, and so get rid of a mass of matter, so that they might know where to look for the vital points. If the salient points were before them, a tender could readily be made, but where they were buried, they were very difficult to find, aud it was easy to overlook them. The same remarks applied as regarded general conditions. A schedule was one of the finest forms of discriminating between the values of various pieces of mechanism, but schedules must not go too far, and he had seen schedules going into the merest details. Cross tendering was undoubtedly a very serious matter at the present day, a great deal of work being absolutely thrown away.

Mr. Eustace Thomas said there were not many things capable of being put down as standards. If consulting engineers or purchasers would state what their requirements were, and also state certain things considered very essential, they would get all that could be expected. It was the manufacturers who had to get together, and not the engineers who first drew up the specifications.

Mr. J. Frith advised consulting engineers to be careful in regard to what they put on the outside sheet of their specification. It was no good putting on the outside that it was a 100-kw. machine, and on the inside that it was a 500 kw. That specification might get into the hands of a non-technical estimator, and he might estimate for it on the size printed on the outside sheet. It did no good to pretend the machine was smaller than it actually was, as was largely done. With regard to specifying results, if a dynamo was required to give a certain output, and they specified that output, together with speed, efficiency and temperature rise, had they not done enough?

Mr. W. Cramp said the consulting engineer was justified in his existence to a great extent by the manufacturers themselves. He had with him a tender which had been sent in to a specification for an ordinary wiring job. It started with the usual covering letter, and on the back of the tender were given certain conditions under which the job was quoted for. On referring to these conditions, it would be found that most of them contradicted the general conditions of the specification. In spite of the fact that rubber cable was specified, 3-core lead-sheathed was offered. On the main switchboard, although it was an a.c. system, 2 moving-coil voltmeters were offered, and 2 volt-meter switches 0-50 amps. The consumption of the lamps was given as 12 watts per c.p. It was this sort of thing that necessitated the employment of a consulting engineer to protect the buyer.

Mr. F. S. Sells said in reply to Mr. Eustace Thomas that what he proposed was to make a start with standardisation, and to ask the consulting and municipal engineers to agree to assist the manufacturers. He thought he had been misunderstood a good

deal as regarded what he meant by standards. What he meant was that each manufacturer should have his own or somebody else's standards. That would still mean a healthy competition between themselves. He did not see how the industry could suffer by that. It was not absolutely necessary for one manufacturer to make everything. Abroad it was entirely different. Replying to Mr. Miller, the author said he did not say that there was the possibility of every consulting engineer having the same idea on a given subject. In other professions there was a certain standard practice. If a consultant was called in and prescribed a certain thing, in the electrical industry, he did not insist on its being done. If a medical man was called in and his advice was not followed he threw up the case. He perfectly agreed with Mr. Pearce regarding one's own standards, and that of course could only be brought about by having authorities in the profession, which the author himself was asking for, but those authorities would never be established unless they were supported from the manufacturers as well as from the profession. He agreed that there was nothing in the standing orders which bound the municipal engineers to accept the lowest tender, though sometimes consulting engineers had better means and opportunities of convincing their clients that the lowest tender was not always the best. He had found that the municipal engineer had not the same opportunity of explaining the differences in the tenders to his committee. If the profession continued very much longer to take excessive advantage of the quarrelling of the manufacturers, in a few years' time they would be very sorry for it, because the time would come when manufacturers would be forced into what many people were afraid of, viz., a combination, that would force prices very high. He, of course, agreed with Mr. Pearce that an engineer should specify the most suitable plant for his requirements; on the other hand, however, he should not ask for tenders. He thought that for a beginning they should state their grievances, and hear the grievances of the other side, and when both sides had discussed the matter in an Institution like theirs they would get some tangible results.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,715. "Electric lamps and reflectors therefor." C. H. Kruger and C. W. Collinson. February 26th.

4,716. "Apparatus for providing electric light on motor road vehicles." T. Clarkson and W. J. Morison. February 26th.

4,730. "Alkaline electric accumulators." W. N. Stewart. February 26th.

4,745. "Screens for rendering luminous projections thereon visible in full light." New Things, Ltd. (E. O. Zechmann, Germany). February 26th.

4,762. "Production of high frequency electric oscillations." W. C. M. Nicholson and F. E. E. G. Schreiber. February 26th.

4,773. "Telephones." T. W. Tattersall. February 26th. (Complete.)

4,780. "Negative carbons for electric searchlights." Gebr. Siemens and Co. (Convention date, April 28th, 1911, Germany.) February 26th. Complete.)

4,781. "Revoluble joint or swivel coupling for electric conductors." M. Cronin. February 26th.

4,783. "Electric incandescent lamps." C. F. Stillman. February 26th.

4,791. "Apparatus for controlling and recording the consumption of electrical energy." H. Gottschalk. February 26th. (Complete.)

4,792. "Electro-magnetically operated circuit-breakers." W. Schroeder. February 26th. (Complete.)

4,820. "Safety electric lamp." A. Sadler. February 26th.

4,828. "Electric incandescent light emitting metalline mantle bodies." E. M. Bailey and H. F. McDowell. February 27th.

4,843. "Process for the production of active substances for lead storage battery plates with the aid of material obtained in the form of thin sheets." A. Ricks. (Convention date, June 13th, 1911, Germany.) February 27th. (Complete.)

4,851. "Electrically-heated clothes or portions of clothing." A. Pollak. (Convention date, March 17th, 1911, Germany.) February 27th. (Complete.)

4,885. "Lightning arresters." K. W. G. J. Stoffels and J. Berkelbach van der Sprenkel. February 27th. (Complete.)

4,887. "Wear-resisting bodies and methods of manufacturing the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 27th. (Complete.)

4,930. "Time-recording device applicable for use with telephones." R. W. Blades. February 28th.

4,975. "Suspenders for overhead electric cables." C. E. Elder. February 28th. (Complete.)

4,983. "Telephone exchange systems." P. Jensen. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) February 28th. (Complete.)

4,984. "Telephone exchange systems." P. Jensen. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) February 28th. (Complete.)

4,991. "Electric arc lamps." G. E. Tate. February 28th.

4,995. "Electrically operated driving systems." Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. February 28th.

5,026. "Tungsten or the like metal-filament and a process of manufacturing same." J. Hubers. (Julius Pintsch Akt.-Ges., Germany). February 28th.

5,027. "Tungsten or the like metal-filament and a process of manufacturing same." J. Hubers. (Julius Pintsch Akt.-Ges., Germany). February 28th.

5,028. "Drawn metal-filament and a process of manufacturing same." J. Hubers. (Julius Pintsch Akt.-Ges., Germany.) February 28th.

5,035. "Intercommunication telephone systems." H. G. White and I. H. Parsons. February 29th.

5,053. "Insulators for telegraph, telephone and other electric wires and cables." T. Taylor. February 29th. (Complete.)

5,054. "Insulators for telegraph, telephone and other electric wires and cables." T. Taylor. February 29th. (Complete.)

5,055. "Absorption dynamo-meter." S. Griffin. February 29th.

5,071. "Couplings or joints for electrical cables and the like." C. J. Beaver and E. A. Claremont. February 29th. (Complete.)

5,083. "Electrical conductors." G. H. Wilson. February 29th.

5,084. "Bulb for electric glow lamps." W. K. Partington. February 29th.

5,805. "Magnetic treatment of hair." W. R. Presland and W. R. Herwin, February 29th.

5,129. "Electroliers, gasoliers, chandeliers, lamp brackets and other gas, electric or candle-lamp supports." P. Betegh. February 29th.

5,170. "Portable electric battery lamps." H. F. Joel. March 1st.

5,206. "Covering for electric cables." C. J. Beaver and E. A. Claremont. March 1st. (Complete.)

5,210. "Process for the electro-deposition of nickel." S. O. Cowper-Coles. March 1st.

5,217. "Mine exploders." Sterling Telephone and Electric Co., Ltd. (Schaffler & Co., Austria.) (Addition to 12145/1911.) March 1st.

5,221. "Telephone or other electric bell extension." C. Rawson. March 1st.

5,278. "Electric photographic copying machines." J. B. Halden. March 2nd.

5,210. "Electric switches." H. W. Cox. March 2nd.

5,301. "Multiple electric arc lamps." Ges. Fur Maschinen-und Metall-Industrie m.b.H. (Convention date, March 2nd, 1911, Germany.) March 2nd. (Complete.)

5,302. "Sparking plugs." H. Zimmermann and R. Slaby. (Convention date, March 10th, 1911, Germany.) March 2nd. (Complete.)

5,322. "Grouping of electrical distributors such as fuses or safety devices for controlling branch circuits." Siemens Schuckertwerke G.m.b.H. (Convention date, March 3rd, 1911, Germany.) March 2nd. (Complete.)

5,336. "Leading electric or other power into revolving structures." R. H. S. Bacon and F. W. H. Shepherd. March 2nd.

5,345. "Metal vapour alternating-current rectifiers and similar apparatus." Hartmann and Braun Akt.-Ges. (Convention date, March 2nd, 1911, Germany.) March 2nd. (Complete.)

5,352. "Automatic block system for preventing collision between trains." A. J. Icard. (Convention date, March 29th, 1911, France.) March 2nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Automatic Sectioning Means for Limiting Accidental Interruptions of Electric Current Supply in Central Stations. E. Brandenburg. 21,001. October 8th. (October 8th, 1910.)

Electric Circuit Controlling Devices. E. M. Hewlett. 23,734. October 2?th. (October 29th, 1910.)

Apparatus for Actuating and Locking Points or Switches on Railways. J. P. O'Donnell and British Pneumatic Railway Signal Co. 25,243. November 14th. (Divided application on No. 2,887 of 1911. February 4th.)

Pole Changers for Electric Motors for use in connection with Electrical Systems of Operating Railway Points and the like. J. P. O'Donnell and British Pneumatic Railway Signal Co. 25,314. November 14th. (Divided application on No. 2,887 of 1911. February 4th.)

Self-Regulating Arc Lamps. Physikalisches Laboratorium Mechanisch-Technische Werkstatte Hans Thoma Ges. 27,817. December 24th. (December 12th, 1910.)

Miners' Electric Safety-Lamps. F. A. Hailwood. 486. January 7th.

Apparatus for the Manufacture of Electric Resistances. J. A. Hirst and P. F. Brook. 2,926. February 6th.

Elevator or Hoist for Rise-and-Fall Electric Light Fittings and the like. A. J. Ware. 3,165. February 8th.

Electric Lighting Systems intended more particularly for Railway Carriages and similar Vehicles. Electric and Ordnance Accessories Co., F. H. M. Langley and H. W. Price. 3,238. February 8th.

Electrical Influence Machines. Morris & Lister, Ltd., D. K. Morris and F. A. Watson. 3,701. February 14th.

Electrical Apparatus for the Manufacture and Welding of Metal Articles. S. Jevons. 3,838. February 15th.

Transmitter for Signalling by Electromagnetic Waves. F. J. Chambers. 4,488. February 22nd.

Telegraphic Systems. P. Faiella. 4,?20. February 27th. (February 27th, 1910.)

Electric Motor Control. British Thomson-Houston Co. (General Electric Co.) 5,620. March 6th.

Electric Cut-Outs. R. Schweitzer and S. Conrad. 6,443. March 14th.

Automatic Regulating Devices for Electric Supply Systems. H. Lake. (United States Light and Heating Co.) 7,528. March 2?th.

Electrically-Controlled Valves. A. H. Nicholson and A. W. Brooking. 8,899. April 10th.

Electromagnetic Lifting Appliances used with Cranes. Steel, Peech and Tozer, Ltd., and H. E. Bowen. 8,951. April 11th. (Addition to No. 30,076 of 1910.)

Secondary Galvanic Batteries. H. P. R. L. Pörscke and J. A. E. Achenbach. 9,944. April 24th. (April 27th, 1910.)

Electrodes for Secondary Galvanic Cells. H. P. R. L. Pörscke and J. A. E. Achenbach. 9,945 and 9,946. April 24th. (May 9th, 1910.)

Electric Switches. W. T. Henley's Telegraph Works Co. and E. E. Judge. 10,747. May 3rd.

Dynamo-Electric Machines. F. Newton. 10,758. May 3rd. (Addition to No. 15,423 of 1?10.)

Electric Arc Lamps of the Open-Arc Type. F. R. Boardman, R. V. Boardman and F. Boardman. 11,873. May 17th.

Systems of Electric Distribution. British Thomson-Houston Co. and F. P. Whitaker. 12,918. May 29th.

Generation of Alternating Electric Current. E. Rosenberg. 12,099. May 31st.

Magneto-Electric Lamp Apparatus for Vehicles. S. Luy. 13,460. June 3rd.

Automatic Switches or Cut-Outs for use in Charging Secondary Batteries from Dynamo-Electric Machines. A. H. Midgley and C. A. Vandervell. 15,039. June 27th. (Cognate application, No. 19,870 of 1911.)

Recording Counter for Telephonic Conversations and similar purposes. Association des Ouvriers en Instruments de Precision. 15,128. June 28th. (July 1st, 1910.)

Electromagnetic Circuit-Breakers. Compagnie des Compteurs Aron. 16,962. July 24th. (July 27th, 1910.)

Telephone Cabinets. O. Sterkel. 17,441. July 31st.

Methods of and Apparatus for Cooling Electrical Machinery. F. G. Baum. 19,760. September 5th. (September 7th, 1910.)

Electric Incandescent Lamps. S. Ecker. 20,643. September 13th.

Electric Switches. H. Lucas and O. Lucas. 21,?95. September 29th.

Sparking-Plug for Internal-Combustion Engines. H. E. Mills. 21,616. September 30th.

Protective Devices for Electric Lamps. W. E. Perry and S. Davies. 23,781. October 27th.